

UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

SYSTEM 9, GSMAP, AND OTHER PROGRAMS FOR THE IBM PC AND COMPATIBLE  
MICROCOMPUTERS, TO ASSIST WORKERS IN THE EARTH SCIENCES

by  
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GSMAP Digitizing and plotting of geologic maps  
GSMUTIL Processing of GSMAP data bases  
GSMEDIT Screen editing of GSMAP data bases  
SETUPDB Setup of GSMAP data bases, projection files, plot control files  
GSMROSE Rose diagrams from linear data in GSMAP data bases  
GSMNET Stereo plots of poles to planar data or lineation data in GSMAP data bases  
GSMPLD Automatic assembly and attributing of polygons from lines and attribute points in GSMAP data bases  
GMPBS Assembly of polygons from lines in a GSMAP data base using the screen to select lines  
8TO9 GSMAP Version 9 data bases from GSMAP Version 8 data bases  
GSSECT Topographic profiles from contour maps  
GSDIG Digitizing geodetic point data into ASCII output files  
GSPOST Selection of symbols according to value in columns of a GSPOST format row column ASCII file  
GSPUTIL Processing of GSPOST ASCII files  
GSPUV Univariate statistics and histograms from one column of a GSPOST format file  
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GSLITH Management, sections, and plan views from drill data  
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GLEDIT Editing and on screen sections from GSLITH data bases  
QUEIT Plotting of HPGL files  
GSREF Management of references using a GSREF data base

Open-File Report  
93-511

DISCLAIMER

Although program tests have been made, no guarantee (expressed or implied) is made by the authors or the U.S. Geological Survey regarding program correctness, accuracy, or proper execution on all computer systems. Any use of trade names is for descriptive purposes only and does not imply endorsement by the U.S. Geological Survey. This report and has not been reviewed for conformity with the U.S. Geological Survey editorial standards.

Denver, Colorado  
July, 1993

## UPDATE TO SYSTEM9 ERRORS AND CORRECTIONS

This file contains a list of all errors or changes in the programs and documentation of System 9 released as Open-File 93-511 in July, 1993. This file is intended for printing using the DOS PRINT command. Doing so will create several replacement pages for the documentation.

### VERSION 9.9

#### SYMBOLS (Standard Set and Coding of new symbols)

A number of users have expressed themselves regarding the difficulty in coding new symbols. Specifically they disliked the use of relative moves. In Version 9.9 we have changed the standard set on the disks (CONFIG9.SYM) to use an absolute set of coordinates. This change required modifying pages 313-316 in the documentation (Coding of New Symbols). Replacement pages containing the new instructions are included at the end of this file and can be printed using the DOS PRINT command.

For users who have created their own symbols we have included a translation program (convsym.exe) which will convert a copy of your CONFIG9.SYM file into a new file called NEW.SYM. This new file should replace the current CONFIG9.SYM. All programs that utilize symbols have been modified to handle the absolute method of specification.

#### CONFIG9.SCR

This file is no longer required. Program will set highest screen resolution (from VGA, EGA and CGA) possible.

#### PERFORMANCE ENHANCEMENTS

Many of the programs were modified to correct obvious design oversights that could affect performance. For instance, GSMEDIT would redraw the screen if user made an error in setting a window even though the window had not changed.

#### METRIC MODE

Version 9.9 has been modified to operate in a metric or english mode. The program will look for the existence of a file called CONFIG9.UNT in the default directory (GSFILES= ). The file should contain one line in uppercase indicating the preferred units. For metric units, use

"METRIC"

For english units, use

"ENGLISH"

If the program cannot find a file called CONFIG9.UNT then it will set ENGLISH as the default.

The program will read in the values for line patterns stored in CONFIG9.PLT. This file is set for english inches on

the distribution disk. If you wish to work in metric units, you should rename CONFIG9.PLT to CONFIG9E.PLT and copy CONFIG9M.PLT to CONFIG9.PLT. This file has the same line patterns defined in centimeters. DO NOT FORGET TO SET THE COMMUNICATIONS PARAMETERS ON THE FIRST LINE!!

Programs will recognize which mode is set and will indicate on the disclaimer screen that metric units are being used.

#### REGISTERED PLOTTING

A number of the programs allowed the user to plot data on paper or mylar base maps by registering the corners on the plotter. This functionality has been removed and replaced by a simpler method. Create an HPGL file and then use a new program called HPGLUTIL (Williams, V. and Selner, G., 1994) which has the ability to register to bases as well as other capabilities. By removing the code from each of the programs and placing it a single program, each program became smaller and memory space was freed for other functionality.

#### GSMUTIL

Two additional utilities were added to the options: the first allows the user to drop small (short) lines that have a "dangling node" on one or both ends. User specifies length. The second allows the user to "sort" the data base from top to bottom. This can improve the plotting time both on the screen (during editing) and on the plotter.

Options 11 and 12 have a new capability to convert lat/lon to ground units in kilometers and back in addition to map inches.

#### GSDIG

Program was modified to plot the symbol and the sample-id on the screen in the color yellow. Previously program plotted only a symbol in the color blue that was difficult to see.

Program was also modified to allow a window to be set thus magnifying the screen display.

VERSION 9.02

General HPGL Fix

In previous Versions the general graphics library routine would create an IP; command at the beginning of a disk HPGL file. In Version 9 the command was modified to include the user supplied values for P1x,y and P2x,y. Unfortunately, when the new IP command was imported into WordPerfect, WordPerfect would hang up. The only way around it was to edit the HPGL file and modify the IP command. Since a number of other error fixes were required, it was deemed desirable to return to the previous practice when creating the IP command. This necessitated

recompilation of all of the programs from Version 9 and changing them to Version 9.01.

QUEIT

Program contained a reference to the CONFIG8.PLT file instead of the CONFIG9.PLT file for Version 9. Error was fixed.

GSLITH

Program contained an error in Option 1 Starting a Data Base and in Option 3 Digitizing (Cartesian coordinates only). Errors were confirmed and fixed. Documentation on page 258 second paragraph contains an error. Last sentence should be removed and replaced with "If a UTM projection is specified, the output coordinates will be true UTM coordinates.". Documentation on page 269 third example has an extra line in the plot control file. Remove the line that reads "1,77,50 |Pen=1....".

GSMAP

Default snap distance was changed from 0.05 to 0.02.

Draft mode was in error. Program was drawing two circles at the end point (none at beginning point) and not labelling beginning point with entry number. Error was confirmed and fixed.

Program would not draw internal grid tick marks if user incorrectly specified plot window. Error was diagnosed and fixed on 12/21/93.

## GSMEDIT

Default snap distance was changed from 0.05 to 0.02.

Documentation on page 93 contains no information on function F=ADD PTS. Following should be inserted at the bottom of the page.

Hit F to be able to insert points into the line. Use the mouse to position the cursor and then click the left button to set a point. When all points have been added, click the right button and hit 1 key on keyboard to exit from the ADD PTS function.

When user chose detail toggle, circles drawn at points where fixed in size. Program was changed to make size a function of parameter stored in CONFIG9.PLT that controls size of node circles at end of lines.

State of Missouri reported that program gave "illegal function code" message and crashed when attempting to run on system equipped with EGA color monitor. CONFIG9.SCR appeared to be properly configured. Several places in program used constants in CALL to CLEAR.WINDOW subroutine. Changed CALL statements to always use integer variables. Could not find an EGA color to test either original or modified. Did test using emulation mode but could not get failure on original or modified. Send to Missouri for testing.

Program would not draw internal grid tick marks if user incorrectly specified plot window. Error was diagnosed and fixed on 12/21/93.

## GSMUTIL

Option 8 was not writing the detail records to the screen when the screen output option was used. Problem was verified and fixed.

Option 15 was not working correctly. Output was being written to the screen instead of the disk file. Error was confirmed and fixed.

Option 15 also had an error when data file had 0 (zero) data columns. Error was confirmed and fixed. However was not reported until after 9.01 was delivered to Open-File Section.

## GSMPBS

User could inadvertently identify same line twice. Test was inserted as each line is identified to check against previously

identified lines and if so, beep issue message and request retry.

#### 8TO9

Documentation was inadvertently left out of release. Several places refer to the 8TO9 program as being on page 136. The following is offered as a minimal substitute. This program is a routine for converting data bases prepared by previous versions to the new file structure of GSMAP Version 9. The program is started by entering the name of the program 8TO9 followed by a carriage return. The program will then request the name of the INPUT data base and the name of the OUTPUT data base. If the input data base contains geodetic coordinates, the program will request the name of a projection file. The program will then request the user to supply a snapping distance. The program will then read the input data base, for lines (1-99) snap the ends and prepare an output data base including a node file. At the end the program will list the number of entries and nodes in the output data base.

Default snap distance was changed from 0.05 to 0.02.

#### GSPUV

At the request of several users the dialogue at the top of page 191 in the documentation and in the program itself have been modified to provide for default answers and an additional question.

Enter the Lower Limit of First Class[0.0]:

Enter the Class Interval:

Enter the Maximum Value to be included[852.5]:

When a default value is included in brackets, a carriage return will cause the value within the brackets to be used. If a different value is desired, then type the value and enter a carriage return. NOTE: the class interval CANNOT be defaulted.

#### GSPOST

At the request of several users an additional option (T) was added to allow the user to return to the beginning of a plotfile and restart processing at that point. Occasionally users would inadvertently (key bounce) enter a duplicate N. This would position them past one of the analysis steps contained in

the plot file. By entering T the user can position back to the beginning of the plotfile and use the N key to step forward to the correct position.

Error was reported that program would occasionally fail to pick up the pen and would attempt to plot with no pen. Error was verified and fixed.

END OF 9.02 UPDATE README FILE

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## CHAPTER 12

### CODING OF SYMBOLS

The file named CONFIG9.SYM contains the definitions of symbols used by GSMAP. The file is an ASCII file that can be modified by use of a word processing program to modify standard symbols or add new symbols. New symbols can be encoded by the user and added to the CONFIG9.SYM file. Coding is easier than might be anticipated. Symbols are drawn with straight lines and/or with circles. Closed polygons defined by lines or circles may be filled. Symbols (in the 200 series) may be rotated by the amount specified in P1 and posted with the number specified in P2 if desired. The CONFIG9.SYM file is limited to 2,000 lines; the standard file released with Version 9 has about 1,500 lines, and so has room to grow.

#### Coding of new symbols

Any unused number with three digits or less can be selected for a new symbol. The numbers 200-299 have special uses, as these define individually rotatable symbols that are rotated according to Parameter 1 and can be posted with numerical values drawn from Parameter 2 in the data base.

#### Starting

To be consistent with other symbols, sketch a square with sides of unit length and a point at the center. provides examples. Assume that the pen is at the center point of the square. Each line of the code describing the symbol provides one instruction to the computer. The center of the square locates the point digitized. A symbol is drawn using straight line segments (moves) and circles. Moves can be either with pen up (no line drawn) or with pen down (line drawn). Moves can be combined to define polygons which will be filled (solid fill). Circles may either be filled or not filled.

The first line of the code for a symbol specifies the number assigned to the symbol and the number of lines (records) required to define that symbol, the X and Y coordinates of the reference point for posting, and the size (in inches) of the height of the numbers to be posted (0's if no posting is desired). Subsequent lines consist of a series of instructions for the plotter. No more than 25 lines may be used.

#### Moves

A line starting with a "PU" tells the plotter to move to a new position with the PEN UP (no line drawn); a line starting with "PD" specifies that the move is made with PEN DOWN (drawing a line). The coordinates for moves are referenced to the center point. After the "PU" or "PD" at the start of a line a comma must be used; the number after this comma specifies the X



coordinate of the next point, then a comma must be used; the number after the second comma specifies the Y coordinate of the next point.

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### Polygons

A line starting with a "PM" is an instruction to the plotter about a polygon.

"PM",0,0 defines the start of a polygon.

"PM",2,0 ends a polygon and ends polygon mode for the symbol.

The polygon defined between "PM",0,0 and "PM",2,0 instructions will be filled with a solid pattern.

Moves between "PM",0,0 and "PM",2,0 instructions should define a closed polygon; if the polygon is not closed, the "PM",2,0 instruction forces a closing of the exterior polygon to the point occupied by the pen when the "PM",0 instruction was issued.

### Exterior and interior polygons

The "PM",1,0 instruction ends a polygon but leaves the computer in polygon mode. This instruction is used between moves that define an external polygon and moves that define an internal polygon to be left unfilled.

The "PM",1,0 instruction forces a closing of the polygon back to the position at the time the "PM",0,0 instruction was issued.

### Circles

A line of code starting with a "CI", instruction calls for the drawing of a circle. The "CI" must be followed by a comma. The number following the comma specifies the diameter of the circle to be drawn. This number is followed by a comma, then by a 0 (zero). The diameter is specified in units relative to the unit square as discussed at the start of this section.

The center of the circle is the point occupied by the pen at the time the "CI" instruction is given. A "CI" instruction defines a complete polygon; it is equivalent to a set of moves between "PM",1,0 instructions, but counts as a single line.

Reference position for posting of symbols Code Group 200-299

A reference position for posting of numbers is given in the first line defining the symbol following the symbol number and number of moves and before the number specifying the size of the posted numbers. This reference position is defined in the coordinate space of the unit box used for coding of the symbols. Check symbols with posting in the CONFIG9.SYM file for examples, especially study definitions of symbols 201 and 202. 0's are used for positions and height of characters for symbols without posting.

Additional information on coding is given in the Interfacing and Programming Manual supplied with HP plotters. Please note that not all HPGL commands are supported by System 9 programs. Use only the commands provided above.

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Examples (refer to Plate 1 to see symbols drawn at size of 100 rasters with 0 rotation):

Symbol 209 (Paired arrows left lateral movement on fault) uses PU and PD moves only with no posting.

```
209 7 0 0 0
"PU", 0.400,-1.000
"PD", 0.400, 1.000
"PD", 0.600, 0.600
"PU",-0.400, 1.000
"PD",-0.400,-1.000
"PD",-0.600,-0.600
"PU",-0.600,-0.600
```

Symbol 14 (Square with lower right filled indicates shaft) uses PU and PD moves and one filled polygon. Note: the "PM",0,0 instruction starts definition of a polygon to be filled; the "PM",2,0 ends the polygon's definition.

```
14 9 0 0 0
"PU", 0.500, 0.500
"PD",-0.500, 0.500
"PD",-0.500,-0.500
"PM", 0, 0
"PD", 0.500,-0.500
"PD", 0.500, 0.500
"PD",-0.500,-0.500
"PM", 2, 0
```

"PU",-0.500,-0.500

Symbol 77 uses PU and PD moves and two circles defined as exterior and interior polygon. The "units" for the diameter of the circles are specified in the same "units" as the "moves" for the pen, based on the unit square.

```
77 15 0 0 0
"PU", 0.000, 1.000
"PD", 0.000, 0.500
"PU", 0.000, 0.000
"PM", 0, 0
"CI", 0.500, 0.000
"PM", 2, 0
"PU", 0.000,-0.500
"PD", 0.000,-1.000
"PU",-1.000, 0.000
"PD",-0.500, 0.000
"PU", 0.500, 0.000
"PD", 1.000, 0.000
"PU", 0.000, 0.000
"CI", 1.000, 0.000
"PU", 0.000, 0.000
```

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Plate 1. Oversize sheet. GSMAP 9 Quick reference chart

Plate 2. Oversize sheet. GSMAP 9 Geologic symbols

# READY SHOOT AIM

The file structure of GSMAP Version 9 is different from the file structure of Versions 3-8. This change was required to fully implement nodes, node snapping, and automated polygon building. A data base consists of three files (extensions LSF, NDX, and NOD).

The program 8TO9.EXE has been included to automate conversion of data bases created in prior versions to the Version 9 format.

## Availability

GSMAP Version 9 as Open File Reports, can be purchased from the Books and Open File Reports Section U.S. Geological Survey  
P.O. Box 25425, Denver, CO 80225  
For information call 1-800-USA-MAPS

## Hardware requirements

GSMAP and all accompanying programs in this SYSTEM 9 release have been designed for use on IBM compatible personal computers. Many of these programs require a digitizer and plotter; all use the same hardware. A complete system includes:

### Microcomputer

The microcomputer must use the DOS operating system Version 2.0 or higher, at least 512K available RAM, two floppy disk drives, or one and a hard disk; at least one serial port, better two (one for the digitizer, the other for the plotter); one parallel port (for the printer); math co-processor chip to match the system; graphics card, IBM compatible CGA, EGA, VGA, Hercules monochrome; monitor suitable for use with the graphics card. Although CGA graphics will work they are not adequate to exploit the graphic capabilities of this version. EGA or VGA color graphics will display different kinds of lines in different colors. EGA and VGA color graphics adapter cards must have at least 256K memory to plot color on screen in EGA/VGA modes. A hard disk or other fast-access storage device is strongly recommended. These programs have been successfully operated on Compaq, Columbia, Hewlett Packard, Sperry, IBM, GRID, Tandon, Zenith, Northgate, Leading Edge, Gateway, and other computers, and should operate on any fully compatible computer. We have seen the programs operate on computers ranging from those that run the 8088 chip and 8087 co-processor at 4.77 Mhertz to others that run the 80486 at 33 Mhertz.

### Printer

The printer must communicate with the computer through parallel port #1 (LPT1:), there are no special requirements for the printer.

### Digitizer

A 16-button cursor is strongly advised (but not required except for GSSECT). GSMAP and GSDIG have been designed and tested using a GTCO DIGI-PAD digitizer with a 16 button cursor and a Summasketch Professional digitizer with a 4 button cursor. They have been successfully operated with Calcomp, Numonics (some in menu mode only), Summagraphics Microgrid II, and other digitizers to our knowledge, and probably can be used with any digitizer that sends ASCII character strings and communicates with the PC through an RS232 serial port.

### Plotter

Plotters must support the HPGL plot language at a level of the HP7475 or above, and the cable connecting the computer and the plotter must be correctly configured. Our tests have been conducted on a Hewlett Packard 7585B and HP-7550A plotters. Remember that the 7550A plotter uses cable unique to

its own needs and different from most other plotter cables.  
Mouse

A Microsoft-compatible mouse can be used as a pointing device with the GSMEDIT, GSMPBS, and GSPOST programs. Use of a mouse is convenient and speeds certain operations. These programs can be fully operated without a mouse using the arrow keys on the keyboard to move cursors on the screen.

## SOFTWARE

The minimum software requirements for utilizing these programs include PC/DOS 2.0 or higher or equivalent MS DOS, the release diskettes, and a word processing program capable of producing ASCII files. Although a RAM-resident program such as SIDEKICK is useful, it can play havoc at unexpected times due to memory conflicts if installed in base memory. We recommend running systems without TSR (terminate and stay resident) or RAM resident programs.

For those new to GSMAP:

Don't fight hardware and new software at the same time. Instructions for interconnection and configuration begin on p. \*\* If you are setting up a new system, use the sample BASICA programs provided in the documentation to help establish communication between your computer, digitizer, and plotter. Read the section on installation and configuration files starting p. 155 before blindly inserting disk 1 into an unoffending drive and discovering that it won't work. You will need files named CONFIG9.SCR, CONFIG9.PLT, and CONFIG9.DIG; these must be customized to match your system's hardware. The files named CONFIG9.SYM, 0.FNT, and executable files (extension .EXE) are also needed, but don't require modification. Read the section on map projections and projection files. If you do you won't expect the sample projection file MAP.PRJ designed for maps using the UTM projection in Colorado to work correctly for your rush project in the Empty Quarter (your next assignment if you don't read the documentation). Start with the glossary, it has all the good stuff. Then go to p. \*\* where instructions are provided for configuring your system. After the system is working, spend a couple of hours doing the GSMAP tutorial project. You'll save time in the long run.

For gurus:

The configuration files (CONFIG8.\*) you're using with System 8 won't work with System 9. proceed at once to p. \*\*. No changes to data files, plot control files, and projection files are required. Changes in the CONFIG9.SYM file modifying certain rarely used symbols may require that you make some minor changes. Font files have not been changed from System 8.

## NEW TO SYSTEM 9.

Van der Grinten, Robinson and sinusoidal map projections are now supported (additions to the previous list). These projections are primarily useful for world maps, and particularly to the GSMAP and GSMEDIT programs.

GSMAP and related programs fully implement nodes, partially supported in Version 5, but not in versions 6-8.

The 18 line types (patterns) of GSMAP are defined in the CONFIG9.PLT file without dependence on Hewlett Packard graphics patterns of dashes, dots, and spaces. Patterns such as the . . . repeated for ephemeral streams can now be produced (line type 13). Lengths of dashes and gaps between dashes can be changed by modification of the contents of the CONFIG9.PLT file using a text editing program.

On-screen messages at the start of a digitizing session provide information on the match between the digitizing setup (digitizer, indexing, hard copy) and the parameters of the data base.

Posting positions for the dip angle for symbols like the strike and dip symbol can be changed by editing to avoid overplotting.

Certain symbols have been changed to better conform to standards being written for maps published by the USGS.

GSMEDIT (on-screen editing and digitizing), now includes digital input by entering numerical coordinates for a point from the keyboard, as well as graphical input from cursor keys or a mouse. Edit functions have been expanded, and nodes can be moved and deleted.

GSMUTIL has two new options. Option 16 generates two digital lines parallel to a previously digitized line. This permits editing of road junctions without the chore of digitizing both sides of a road. Option 17 generates points for a splined line from a digitized trace. Used in combination with Option 9 (Filter), lines can be smoothed by splining to a file; this should be followed by filtering to decrease plot times.

GSMNET (NEW) is a program used to produce stereographic or equal area plots of poles to planar features or linear features using data from a GSMAP data base.

SETUPDB (NEW) is a program which provides interactive support for the creation of GSMAP data bases, grids of lines, plot control files, and projection parameter files.

GSPPOST will operate on files with unlimited numbers of sample points (rows); new pen optimization routines have been incorporated to reduce plot time for large data sets. Test sets plotted with GSPPOST 9 selecting from 3 pens took less than half the time as when using GSPV85. Time reductions are data set and plot file dependent.

GSGRCO (NEW) is a program that draws data from GSPPOST files, uses a  $1/d^2$  algorithm to create a grid, then a minimum curvature algorithm to create contours in a GSMAP data base.

GSREF, storage and management of references (key words) QUEIT (plotting from HPGL files) has been modified for pen optimization and sequential plotting from a series of files.

Version 1.0 of GSDRAW and GSMAP was released in February 1986, Version 3.0 in August 1986, Version 4.0 in September 1987, Version 5.0 in May 1988, Version 6.0 in August 1989, Version 7.0 in January 1991, Version 8 in February 1992, Version 9 in \*\*\*\*, 1993.

## SYSTEM 9

As with System 8, this release brings together a series of programs for IBM compatible microcomputers and standard peripheral devices. The functions of these programs are briefly described in this introduction. All have been revised from previously published versions and some are new to this release. The functions and methods of operation of these programs described in subsequent sections in considerable detail. All graphic output can be drawn on a plotter, on the screen or sent to a disk file using HPGL (the Hewlett Packard Graphics Language), including text and symbology. The on-screen graphics can be used to assist digitizing, editing, and design of output. All of the programs in this set can use either Cartesian data (X, Y coordinates) or geodetic data (latitude, longitude coordinates). The choice of coordinate system is made by the user. Cartesian coordinates are most useful for illustrations, cross sections, and maps where latitude, longitude coordinates are unavailable, where the use of a geodetic system adds unneeded complexity, or where it lacks sufficient precision (e.g. a map at a scale of 1 inch equals 1 foot). When working with geodetic coordinates, these programs support Mercator, Universal Transverse Mercator, Trans-

verse Mercator, Oblique Mercator, Lambert Conformal Conic, Albers Equal Area, Equidistant Conic, Polyconic, Sinusoidal, Van der Grinten, and Robinson map projections. Design goals required an "office-scale" hardware system with an affordable price. All of the programs operate from menu screens and are fully prompted. On-screen messages supply needed information and prompts call for responses from the user at appropriate times. Responses from the keyboard are entered by typing appropriate answers to the prompts, and then hitting the ENTER key. Default choices are indicated on the screen using upper-case letters; other acceptable responses are indicated in lower-case letters.

The same sets of symbols and fonts are used by all programs in this release. Symbol and font definitions are contained in ASCII files that can be extended or modified by the user; line patterns can be modified. The documentation contains instructions on how to design new line patterns and symbols.

These programs are oriented for use by geologists and other scientists, not for computer specialists. Programming skills are not required. Some knowledge of DOS and the ability to create and modify ASCII text files is required.

## DOCUMENTATION

The documentation is organized into a series of chapters. Chapters 1-4 deal with programs that create, modify, or use data from GSMAP digital data bases; the GSM series and related programs. Chapters 5-\* deal with programs that create, modify, or use data in GSPPOST format row column ASCII files; the GSP series and related programs.

## A QUICK VIEW OF SYSTEM 9

### GSMAP

GSMAP and related support programs including GSMEDIT, GSMUTIL, GSMPLD, GSMPLBS, and SETUPDB have been developed to assist geologists and illustrators in compilation and publication drafting of geologic maps and illustrations. These programs attempt to facilitate geologic map compilation and drafting in the way that digital word processing facilitates composition and editing of text. As a set of practical graphics programs, they enable digital compilation of graphical elements, ease the process of modification in response to second thoughts, editorial comments, and scale changes, and lead from initial compilation to publication without redigitizing or redrafting. GSMAP uses a high precision digitizer and plotter for entry and plotting of digital data. Program capabilities include modification of data bases by deletion of unwanted entries or additions at any time. Part or all of the data in a data base can be plotted. Words and alphanumeric characters are entered into an ASCII file using a word processing program, and their locations are entered by digitizing. Entries are numbered by the program and can be edited or deleted using this number. Although the primary output is to the plotter, plots of all data can be drawn on the screen. Plots can be made in two modes; the "draft" mode provides entry numbers, the "publication" mode draws plots without entry numbers. GSMAP data bases using the same coordinate system can be merged. GSMAP supports lines of 18 pattern types, symbols, patterning of polygonal areas, text (with leaders if needed), multi-line text entries, and text that flows along features such as rivers, fault lines, etc.

The documentation provides a thirty page Tutorial that leads you key stroke by keystroke through the digitizing and plotting of a simple illustration that contains the elements of a geologic map. For a person who understands DOS and a modern word processing program the tutorial exercise requires approximately two hours to complete. Our internal training course is heavily oriented to hands-on participation and consists of two

eight-hour days of lectures and exercises with approximately two hours dedicated to a discussion of projections.

## PROGRAMS FOR USE WITH GSMAP DATA BASES

### GSMUTIL

Options:

1. To create a new data base containing entries selected by code from an existing data base, or to select the entire contents of a data base with deleted entries removed.
2. To create an ASCII file from an existing data base. The file can contain specified entries selected by code or the entire contents of the data base.
3. To select entries from an existing data base inside one or more digitized polygons in another data base.
4. To create a data base from a formatted ASCII file.
5. Select entries inside or outside one polygon defined by points in an ASCII file from an existing data base.
6. To write a formatted ASCII file for use with 500-599 codes. Sequential numbering and proper punctuation are automatically provided.
7. To merge two or more data bases to form a new output data base containing combined entries.
8. To compute the lengths of lines and the areas and perimeters of polygons.
9. To filter the contents of a data base and create an output data base.
10. To read an input data base, snap node points (ends of lines) together and create an output data base.
11. To convert a geodetic data base to a Cartesian data base.
12. To convert a Cartesian data base to a geodetic data base.
13. To generate a Cartesian or geodetic data base containing a grid of lines at spacings chosen by the user.
14. To prepare a listing of codes used in an existing GSMAP data base.
15. To read a GSPOST data base and create an output GSMAP data base.
16. To read lines from an input GSMAP data base and generate an output GSMAP data base containing paired lines, one on each side of the input lines at a user-specified distance.
17. To read lines from an input GSMAP data base and generate splined lines in an output GSMAP data base.

### GSMEDIT

This screen edit program permitting editing of data bases using either geodetic or Cartesian coordinates using the keyboard of the computer or a mouse. Points or entries can be deleted, points moved, CODE, P1, and P2 changed; lines broken into segments; the sequence of points in a line reversed, and on-screen digitizing accomplished.

### GSMPLD

This program assembles polygons from digitized lines, (entries code groups 1-99, from an existing data base and assembles these lines into closed polygons in an output data base.

### GSMPBS

This program allows the user to select specific lines using the screen display (entries code groups 1-99, 400-499, 600-699) from an existing data base and assembles these lines into closed polygons or into composite lines in an output data base.

### GSMROSE

GSMROSE is a program for construction of rose diagrams from linear data (lines or polygon boundaries) in a GSMAP data base. The user can specify the radius of the diagram, the angular measure of the sector used for analysis, and output to the screen, to a plotter, to a disk file written in HPGL,

or to a GSMAP data base in Cartesian coordinates (new to this version). After drawing the rose diagram, a table can be printed that provides the numeric information used in constructing the diagram. Two methods of analyzing the linear data are provided, one length weighted, the second, count weighted. When using the length-weighted option the program reads the data for a specified code (lines or polygon margins) in a data base, calculates the bearing and length of each interval between points along the lines, accumulates these lengths for angular sectors of bearing as specified (e.g. if 5 degrees was specified, for 0 to 5, 5 to 10 and so on through 175-180), calculates the total length of line segments in each sector, and divides the length in each sector by the length in the maximum sector. This ratio is used in the rose diagram as the radius for the sector. The radius of the diagram for the sector of maximum length is chosen by the user. For data bases that use Cartesian coordinates the Y coordinate of the data base is used as the Y coordinate (0 degrees) for the rose diagram.

### GSMNET

GSMNET is a program used to produce stereographic or equal area point plots from data on planar or linear features drawn from a GSMAP data base, or from an ASCII file. Output is to the screen, to a plotter, to an HPGL file, or to a GSMAP data base.

### CROSS SECTIONS GSSECT

GSSECT is a program that enables quick and accurate generation and plotting of the topographic profile for cross sections, and other profiles drawn from contour maps. Version 9.0 of this program has been revised from Version 2.0 so that it uses the same configuration files as GSMAP Version 8, to interface with digitizers and plotters. It can plot sections to the screen, to files written in HPGL (Hewlett Packard Graphics Language), drive plotters, or generate a GSMAP data base in Cartesian coordinates. Drawing the topographic profile for structure sections is a chore not relished by most geologists, and with conventional drafting techniques is beset with pitfalls and inaccuracies. The use of a precise digitizer for data input and of a plotter to draw the section, eliminates most of these problems, and speeds the entire process. Using GSSECT Version 9.0, a topographic profile may be drawn along a straight line, along connecting straight line segments, such as a section with a bend, or along a curve (many short line segments), such as the course of a stream. The gradient between points of known elevation can be computed, printed, and plotted to assist analysis of a profile.

### DIGITIZING OF SAMPLE LOCALITIES GSDIG

GSDIG Version 9.0 is a program that makes use of a digitizer to determine geodetic (latitude, longitude) coordinates or Cartesian (X, Y) coordinates from maps or drawings and create ASCII character files containing site identifiers and geodetic coordinates (degrees, minutes, seconds) or Cartesian coordinates in units from the drawing or digitizer units (usually inches). Geodetic coordinates for points can be digitized from any map that has latitude/longitude coordinates for four points and has been drawn using one of the supported map projections.

The output format for ASCII files can be chosen to provide easy input of data to spreadsheet, data base management programs, or to geodetic or Cartesian data bases in GSMAP format. Alphanumeric site identifiers are in part entered from the computer keyboard computer, in part entered from the digitizer keypad. An option in the utility program, GSMUTIL, is included so that digitized geodetic (latitude, longitude) or Cartesian (X,Y) data in GSPOST format or can be directly entered into a GSMAP data base. Data from a series of maps can be digitized and the data stored in a single output file in a single digitizing session without leaving the program. Alternatively,

data can be added to an existing file permitting use of a single file in several digitizing sessions. Use of a "mask" composed of prefix and suffix entered from the keyboard permits alphanumeric identifiers for sites to be entered from the numeric keypad of the digitizer during digitizing. The prefix, maximum number of digits, and the suffix can be changed during digitizing without reentering the coordinates of the corners of the map, or reindexing the map to the digitizer.

## PROGRAMS UTILIZING ROW-COLUMN ASCII FILES

### GSPOST

GSPOST draws data from a GSPOST format file, draws plots on the screen, on a plotter, or writes to a disk file in HPGL to make maps displaying information associated with geographic sites by drawing symbols and/or posting numerical data. GSPOST selects symbols according to values in a data column as specified in a plot control file, and can post numerical value in a default position, in alternate positions, and at selected angles to reduce over-posting. Its on-screen display assists analysis and editing.

The user must supply an ASCII data file that contains a series of rows and columns. Each row contains a series of attributes that apply to one data point. Each column contains one kind of attribute. The first columns of each row are "control" columns providing the site's identifier, the coordinates of the site and the position and angle posting numerical values. Additional columns to a total of 50, are data columns. Latitude/longitude information can be specified either in decimal degrees, or in degrees, minutes, and seconds. Both formats cannot be used in a single file. X,Y coordinates are specified in a system appropriate to the map; these cannot be mixed with latitude,longitude coordinates in a single data file.

GSPOST allows the user to specify the column from which data will be selected, values or ranges in values (class intervals), and choose different symbols (and/or different symbol sizes for each class, with or without posting of numerical values, or the posting of site identifiers. The position of posting of numerical data at each site can be adjusted to reduce over-printing of numbers by changing the position and/or the angle of the posting. These adjustments are made by on-screen editing. For any given map the X and Y scales are independent; the area is specified using the coordinates of corner points in the coordinate system chosen for locating data points (latitude,longitude or X,Y).

### GSPUTIL

Options provide conversion of the location coordinates of GSPOST files from one coordinate type to a different type, sort files into geographic blocks to reduce plotting time, and select data points either inside or outside areas defined in ASCII trim files.

## GRAPHS AND STATISTICS

GSPUV calculates univariate statistics parameters and generates histograms from data drawn from a selected column.

GSPPROB generates probability diagrams drawing data from a single column.

GSPXY constructs X,Y plots from two selected columns and provides regression coefficients.

GSPTD generates a ternary diagram using data from three selected columns.

## GRAPHIC SECTIONS

GSPCS produces graphic cross sections from data in selected columns.



## CONTOURING AND GRIDDING GSPDC

GSPDC provides contouring and gridding of data taken from one data column, based on generation of Delaunay triangles. A review procedure assists identification of anomalous points, be they real anomalies or artifacts produced by problems in the input file.

## GSPGRCO

GSPGRCO provides a program to go from an ASCII file that provides the coordinates of a series of points and a value for a parameter at each point, through review to verify the data, to a gridded data set, to production of a contoured map on screen, to a GSMAP data base, and to a plotted map by using the GSMAP program for editing and plotting. The gridding algorithm has two parts, listed here in order of priority. If a grid point falls exactly on a data point, the value for that point will be selected. The main sequence of calculations are used to calculate a value for the grid point weighting values from data points according to the inverse square of their distance from the grid point. The user specifies a maximum distance from the grid point within which data will be used for computation of the grid point value; points at greater distances will not be used. If there are no data points within the assigned maximum distance of the grid point, no value is assigned for that point. The grid spacing and maximum distance are selected by the user and entered independently, to allow specification of the best values for the data set being processed. Like GSPDC, a review procedure assists identification of anomalous points, be they real anomalies or artifacts produced by problems in the input file.

## GSLITH

GSLITH is a program designed to organize, store, and process data that define the "vertical" sequence of rock units at locations specified by latitude, longitude coordinates or by Cartesian coordinates. The program's name comes from Geological Survey Lithology. The program requires an IBM PC-compatible microcomputer and a digitizer and a plotter for full implementation. The format of the GSLITH data files for Version 9 has been changed from that of System 8. This change has been made so that Cartesian coordinates could be supported (geodetic only in Version 8). Data bases used by GSLITH System 8 can be converted to Version 9 using Option 12 of the GSLUTIL program.

Graphic and numeric output from GSLITH data bases assist analysis of lithologic and associated numeric data from drill holes. The words "hole" or "well" are used in this documentation to indicate a place where data on the vertical sequence of units are available, with obvious extensions to an outcrop. Lithologies and graphical numeric data are shown on plots by lines and patterns chosen by the user and drawn on cross section and plan views.

The program can draw a series of cross sections from drill hole data plotting the lithologic units in the drill hole, and numeric variables (such as chemical values) at true positions as projected to the vertical plane of section. This provides a quick and accurate way of determining the consistency of a data set, locating critical holes, identifying errors in the data, and starting the process of data analysis. These sections also furnish a basis for construction of standard cross sections, allowing the geologist to connect like features without the tedium of projecting well data to the plane of section.

Plots of drill holes on cross sections can be made at true elevations, or adjusted so that the base or top of a specified unit, or a particular contact is plotted at a specified elevation. Such alignment of a stratigraphic horizon may facilitate strati-

graphic analysis. If a contact is specified, only those holes where this contact has been identified in the data will be plotted. A type of block diagram can be constructed on a single sheet by drawing a series of stacked cross sections, thus providing an overview of a data sets in three dimensions. The program projects data from slant holes to the plane of cross section in proper geometric projection, including changes in apparent thickness of units and apparent plunge of slant holes to accommodate the bearing and plunge of the hole and horizontal and vertical scale selected for the section.

Plan views can be drawn to provide information on the stratigraphic and structural framework of an area. A plot of the elevation of the contact of two units provides data for construction of a structure contour map. A plot of the thickness of a unit provides data for construction of an isopach map. ASCII files generated by GSLITH can be used with computer-driven contouring programs. If the elevation data from a series of holes are adjusted to bring a particular contact to a specified vertical position by the program, a plot of the vertical offset required for this adjustment provides insight into the shape of this contact in three dimensions. Horizontal slices through well data sets provide data for a subsurface geologic map at the chosen elevation. Figure 36 is a plan view of a hypothetical set of drill holes. Examples of plots from GSLITH are provided in figures 37-40, p. 290-295.

GSLITH can be used to digitize the locations of drill holes, measured sections, or other places where information has been obtained. It stores information about the vertical extent of units at each locality, and as many as five numeric variables that apply to each unit. It employs a user-defined "standard set" of unit identifiers. Input of data for units at each locality is checked against this standard set to guarantee consistency. Plotter patterns are specified by the user for each unit, and are used in drawing plan views and cross sections. As many as five numeric variables associated with each unit can be stored in the data base and plotted on sections.

Upper and lower vertical limits can be specified for sections, and data within these limits plotted. This allows use of a greater range of vertical scales without exceeding plotter limits. The map projections supported for digitizing and plotting include the Mercator, Universal Transverse Mercator, Transverse Mercator, Oblique Mercator, Polyconic, Lambert Conformal Conic, Albers Equal Area, and Equidistant Conic.

## GSLUTIL

The utility program GSLUTIL assists in working with data bases, including the reformatting of Version 8 GSLITH data bases to Version 9. Its options enable export and import of ASCII files from and to GSLITH data bases, change of identifiers for specific beds throughout a data base, geographic trimming to select parts of a data base, and perform other tasks related to management and editing of data bases.

## GSLEDIT

GSLEDIT facilitates review and editing of GSLITH data bases. Sections can be drawn on the screen, wells selected for edit based on the graphical display in section view, the contents of the data base modified as needed, then re-checked in section view to verify changes.

## GSREF

GSREF is a program that facilitates management of bibliographic references, alphabetizes references, and allows searches based on references and or key words assigned to each reference.

## INTERCONNECTION OF HARDWARE

Please refer to the Installation section of this documentation for such details as we can supply and a worksheet (p. 318) to assist configuration of the system. Manuals supplied with computer, digitizer, and plotter contain details and explanations of switch settings, cable specifications, and details about interconnection and configuration of particular hardware.

## INSTALLATION OF SOFTWARE

The programs of System 9 are contained in self extracting archives on the two release disks. The contents of the archives are described below.

make a directory on your hard disk to receive the files, some 1.6 mbytes in total. Make this directory the active area, put the release disk in a floppy disk drive, e.g. A: Type A:SYS9. The files in operational format will be added to the active area of the hard disk.

Add a statement of location for **GSFILES** e.g. **SET GSFILES=C:GS** to the computer, s **AUTOEXEC.BAT** file. Make a directory with the specified name, then copy configuration files from the archive **GS.exe** into this directory by making this directory the active area, placing disk #2 in the appropriate drive, and typing **B:GS** to add the (**CONFIG9.\***) and font files (**\*.FNT**) to the specified directory (in the example above **C:GS**). The executable programs should be copied into an active directory (one specified in the **PATH** statement of the **AUTOEXEC.BAT** file), from the archives **SYS9.EXE** and **POST9.EXE**:

**GSMAP** requires four configuration files, **CONFIG9.DIG**, **CONFIG9.PLT**, **CONFIG9.SYM**, and **CONFIG9.SCR**, and the font file **0.FNT**, and other font files that may be used in a given plot. Other programs have varying needs, but all are well served if all **CONFIG9.\*** files and **\*.FNT** files are in the location specified by the environmental variable.

If no environmental variable is specified, the required configuration and font files must be in the directory that contains the program file, and the programs must be operated from this directory. This may necessitate multiple copies of these files, and consequent unnecessary use of disk space.

### Configuration

The files **CONFIG9.SCR**, **CONFIG9.DIG**, and **CONFIG9.PLT** must be configured to match your hardware system. Details are provided in the section "Hardware installation and configuration files" beginning on p. 317.

Refer to the section starting on page 317 for installation of hardware. Use the worksheet p. 318 to record the parameters of your system. Pay special attention to the details on configuration files. Modify the three configuration files **CONFIG9.SCR**, **CONFIG9.DIG**, and **CONFIG9.PLT** to match the physical setup of your system. These modifications can be made using a standard word processing program. Check about the use of the menu template for digitizers with less than 16 keys, and even for use with 16 key digitizer keypads if different ASCII codes aren't sent by each key, or if different numbers of characters are sent by different keys.

### FREE ADVICE

Understanding the meaning of a few terms is critical to operation of these programs. These critical terms and others of lesser import are defined in the glossary near the end of this document, p. 355; it's recommended reading for a Saturday night.

Be sure that you understand the meanings of the term **ENTER** as used with the keyboard, with the digitizer keypad and with the plotter. All programs use the convention that a data base is specified by name without use of the DOS extension(s), and that all files are specified by complete name with extension, with drive and directory, if other than the active area).

## PLOT CONTROL FILES

ASCII plot control files are required by many of these programs. Please do not assume that a plot control file for one program will necessarily work correctly with another. The requirements of different programs may be entirely different.

## DEFAULT VALUES

At many points in the programs described here, prompts indicate choices that have default values (hit the **ENTER** key). Default choices are indicated in Upper case letters; lower case letters designate the other valid choices.

### *Mus Microsoft*

A mouse can be used as a pointing device with the graphics screens of **GSMEDIT**, **GSMPBS**, and **GSPOST**. Microsoft-compatible mouse driver software must be installed (see instructions in mouse documentation), and loaded, generally a function of instructions in the **CONFIG.SYS** file before opening one of these programs in mouse-mode. With these programs the Microsoft-compatible mouse can be used to move about the graphics screen and locate points, but not for choice of options. In general, select options using hot keys on the keyboard (no **ENTER** keystroke required), use the mouse to move the cursor about the screen instead of using the arrow keys on the keyboard (as used in the keyboard mode of operation), and use the left key on the mouse to select a location. If for example, you want to set a window to enlarge a portion of the screen, hit **B** on the keyboard to select the "set window option", use the mouse to move the cursor to the lower left corner of the window to be selected, press the left key, then move the mouse cursor to the upper right corner of the window, and press the left key to establish the second corner of the window.

In the input mode, **GSMEDIT**, the "arrow key" digitizing procedure requires the use of the 0, 1, 2, and 3 keys to specify function. With the mouse, click the left key instead of the 0 key on the keyboard, click the right key to return operation to the keyboard, then hit the 1, 2, or 3 key on the keyboard to specify the function of the right-key stroke. This resembles the procedure required for operation of **GSMAP** with a one-key digitizer, where a return to the menu template is required to specify the function of the last key-stroke.

Digitizing a closed rectangular polygon in mouse-mode would require, L click, L click, L click, R click, hit 2 key on keyboard. In mouse-mode, The keyboard instruction tells **GSMEDIT** the function required for the point indicated by the right click from the mouse.

### Plot Register

A word of caution about the **PR** plot register option of **GSMAP**, and **GSPOST** that provide a way of using a plotter to make a plot registered to corners drawn on the sheet, i.e., here's a way to draw a geologic map on a paper copy of the topographic base. This process uses a temporary **HPGL** file (created then deleted). Although you won't ever see this file, space must be available on the working drive so that the computer can create and use it. For this reason, use a directory with plenty of space on your fastest drive. Some of these **HPGL** files can be large, very much larger than the data base files. One of ours for a complete and patterned 15' quadrangle is over a Megabyte in size. This **PR** process isn't practical when using floppy disks.

## Progress

Version 9 replaces Open File Reports 90-229, 92-217, 92-260, and 92-372

The Release disks are in the form of self extracting archives created by LHARC.

Disk #1 contains the file SYS9.EXE which will provide the following programs:

8TO9 EXE 89304 07-20-93 8:17a  
GSMAP EXE 266826 07-20-93 9:53a  
GSMEDIT EXE 250504 07-20-93 10:52a  
GSMUTIL EXE 184772 07-21-93 10:35a  
GSMPLD EXE 106142 07-20-93 8:00a  
99 WS 0 07-22-93 6:05a  
GSLITH EXE 281628 07-20-93 8:04a  
GSLEDIT EXE 207966 07-20-93 8:06a  
GSMPBS EXE 149542 07-20-93 7:57a  
GSLUTIL EXE 137914 07-20-93 7:52a  
SETUPDB EXE 101626 07-20-93 8:11a  
QUEIT EXE 56712 07-20-93 7:48a  
GSMNET EXE 100826 07-20-93 8:09a  
GSREF EXE 128888 07-20-93 8:23a  
GSMROSE EXE 135306 07-20-93 7:55a  
GSDIG EXE 125386 07-20-93 7:58a  
GSSECT EXE 87788 07-20-93 8:02a

Disk #2 contains the file POST9.EXE which will provide the following programs:

GSPOST EXE 192820 07-20-93 8:08a  
GSPXY EXE 117516 07-20-93 7:44a  
GSPTD EXE 98514 07-20-93 7:46a  
GSPCS EXE 195906 07-20-93 7:47a  
GSPPROB EXE 102414 07-20-93 7:49a  
GSPUTIL EXE 117888 07-20-93 8:12a  
GSPGRCO EXE 191586 07-20-93 8:13a  
GSPUV EXE 109154 07-20-93 7:56a  
GSPDC EXE 207538 07-20-93 8:03a

Disk #2 contains the file GS.EXE which will provide the following files:

CONFIG9 SCR 8 03-31-92 1:03p  
CONFIG9 SYM 24576 07-12-93 10:33a  
99 FNT 15488 01-19-93 11:36a  
CONFIG9 PLT 640 03-05-93 8:05a  
CONFIG9 DIG 256 09-02-92 6:56a  
4 FNT 23552 05-25-89 1:29p  
3 FNT 42112 08-05-92 1:40p  
22 FNT 52352 01-20-93 7:26a  
5 FNT 25216 08-05-92 1:46p  
SETUPDB TAB 17536 09-10-92 1:50p  
0 FNT 37888 01-19-93 12:31p  
1 FNT 39424 01-19-93 3:34p  
2 FNT 51584 01-20-93 7:12a

Disk #2 contains the file EXAMPLES.EXE which will provide the following files used as examples for programs in this release:

LL PRJ 56 01-03-92 7:56a  
LL EXC 128 03-05-90 12:03p  
LL PLT 256 06-10-93 9:10a  
LL PRN 2944 06-10-93 11:42a  
LL SEC 256 06-10-93 12:06p  
EXAMPLE NDX 364 06-10-93 6:46a  
EXAMPLE SEC 128 11-25-91 9:26a  
EXAMPLE PLN 256 12-02-91 12:04p  
EXAMPLE BED 128 07-13-88 9:12a  
EXAMPLE LSF 1296 06-10-93 6:46a  
SECT4 LST 128 01-23-92 10:15a  
EXAMPLE PRJ 128 10-26-87 8:01a  
EXAMPLE SAM 256 03-23-88 8:05a  
EXAMPLE LST 128 01-23-92 10:15a  
EXAMPLE DAT 385 02-04-92 7:28a  
EXAMPLE POL 384 05-03-91 10:14a  
SECT1 ASC 100 01-21-92 12:58p  
EXEDIT PLT 51 01-27-92 11:01a  
SECT1 PLT 131 01-17-92 12:22p  
SECT2 PLT 138 01-21-92 12:54p  
PLAN2 PLT 163 01-31-92 8:51a  
SECT3 PLT 128 01-21-92 11:13a  
SECT4 PLT 101 01-23-92 9:48a  
PLAN1 PLT 256 01-11-93 11:42a  
PLAN3 PLT 256 01-11-93 11:46a  
HIST VAR 128 04-04-88 7:41a  
TRACE VAR 128 09-15-88 3:17p  
LABEL VAR 128 05-03-93 10:22a  
DRAW9 SAM 256 03-23-88 8:05a  
DRAW9 NDX 1876 04-09-93 9:20a  
COLORADO NDX 1140 04-03-90 3:32p  
COLORADO KEY 144 04-03-90 3:28p  
DRAW9 LSF 18272 04-09-93 9:20a  
DRAW9 RU 237 01-08-93 7:57a  
DRAW9 PLT 1408 01-08-93 7:50a  
DRAW9 NOD 540 04-09-93 9:20a  
MAP9 PRJ 128 02-07-88 12:43p  
MAP9 NDX 1876 04-09-93 9:19a  
MAP9 LSF 18304 04-09-93 9:19a  
MAP9 PLT 1408 01-08-93 12:48p  
MAP9 NOD 540 04-09-93 9:19a  
MAP9 ASC 512 05-05-93 9:42a  
COLORADO REF 3240 04-03-90 3:32p

## CHAPTER 1 GSMAP VERSION 9

GSMAP Version 9 uses a different data base structure than Versions 3-8. The conversion program 8TO9.EXE will convert a Version 3-8 data base to a Version 9 data base. The change in data base structure was required so that nodes, abandoned after Version 5, could be re-introduced. Each data base consists of three files bearing the data base name with extensions LSF, NDX, and NOD. This change reflects the growing use of GSMAP for complex maps (larger data bases), and the need for greater capabilities, in part offered by the revised version of GSMPBLD, a program that will automatically build polygons from line segments.

Chapter 1 provides documentation for the operation of the GSMAP program. GSMAP creates, modifies and draws data (geodetic or Cartesian coordinates) from three direct access binary files that constitute a data base. The GSMAP file format is described pp 58,59. All entries in the data base have a numbered attribute called a code. Codes are organized into groups with specific functions. Each entry has a code and P1 and P2 (parameter 1 and parameter 2 values). Uses of the P1 and P2 values differ among different code groups. Much of this documentation centers on use of Code, P1, and P2 and on plot control files.

### CODE

Code is a number specified in digitizing or plotting. Different codes have different functions, some are specific to a particular symbol, others can be used for lines, others for polygons, others for alphanumeric entries. Planning for proper use of codes is essential to creating good maps. Codes for entries can be easily changed, either as a group, or for individual entries.

### CODE GROUPS

Nine code groups are used, each with specific and different functions. Uses of these code groups are summarized below.

#### Code Group: Function

1-99	Lines, including lines decorated with symbols. Digitized points will be connected with straight line segments when line is plotted.
100-199	Symbols and posting of associated data drawn from ASCII files.
200-299	Individually rotatable symbols, such as strike and dip symbols. Each code is used for a specific symbol.
300-399	Other symbols individually sized by user.
400-499	Polygons, closed figures that can be patterned.
500-599	Text. Alphanumeric characters drawn from ASCII files. Multi-line entries. Entries with leaders:, the first point digitized sets location of text, subsequent points define leaders.
600-699	Splined lines. Lines will be smoothed during plotting by a curve-fitting algorithm that honors all digitized points.
700-799	Text. Alphanumeric characters drawn from ASCII files. Single line entries only for each entry No leaders One point digitizing sets location of text Two point digitizing defines slope of words Three to 5-point digitizing of an entry defines a line, characters are evenly spaced along the line defined by digitized points Six or more point digitizing of an entry defines a line, characters are spaced evenly along a <u>splined</u> line defined by the digitized points.
800-899 polygons.	Polygons, more closed figures that can be patterned, just like the 400-499 codes, but adds another 100 codes for polygons.

Plot control files are discussed, p. 23-34, their makeup for each of the code groups in the section, p.26-50, and their generation using SETUPDB p. 53-57. One quick way of looking into GSMAP is to use the data base DRAW supplied with this release, using its plot control file DRAW.PLT (diagram Fig. 12) and trying the various options of GSMAP and GSMEDIT. The tutorial may be instructive, especially as the court of last resort, for despite our efforts to serve experienced and neophyte users, we risk presenting too much and too little (see \*documentation in the Glossary). Vainglorious exit. At any point in program operations that a keyboard entry is expected, striking the control and C characters together (^C) will return the system to the DOS prompt, but watch out, at certain points in program operation you can lose data not yet stored on disk.

## OPERATION OF GSMAP VERSION 9

The GSMAP program interacts with the user either by requesting choices from a menu or responses to prompts. Menus are displayed on the screen with numbered choices followed by an abbreviated text. Responses to menus are made by typing the number of the desired choice, then hitting the Enter key. Responses to prompts, such as for names of files are similarly made by typing the response, then pressing the Enter key. GSMAP makes extensive use of auxiliary ASCII files, such as text files, projection parameter files, and plot control files. Required files should be prepared before starting GSMAP. Peripheral equipment such as the digitizer and plotter should be turned on before starting program operations.

GSMAP is started by entering GSMAP from the DOS prompt. A "disclaimer" screen will be displayed briefly, then the Main Menu screen. When starting, the Main Menu will look like the diagram below except that the area occupied by the words DRAW, CARTESIAN, and EXERCISE will be blank. After starting (opening) a data base this area displays the name of the data base, either CARTESIAN or GEODETIC to remind you whether the data base uses Cartesian or geodetic data, and the title associated with the data base.

All working sessions must begin either by starting a new data base, Option 1, or by opening an existing data base, Option 2. When either of these options is selected a listing of all files with .NDX extensions in the default area will be displayed to remind you of the names of existing data bases in the default area (each data base consists of three files with the extensions NDX, LSF and NOD).

Glorious entrance. When starting GSMAP and many other programs in this release, if you type the name of the program, a blank space, then the name of an existing data base, the program will begin and open this data base.

### GSMAP Main Menu

DRAW CARTESIAN EXERCISE	
G S M A P SYSTEM 9.0	
1 -	START A NEW DATA BASE
2 -	OPEN AN EXISTING DATA BASE
3 -	DIGITIZE NEW ENTRIES
4 -	DELETE ENTRIES
5 -	RECOVER ENTRIES
6 -	CHANGE PARAMETERS FOR ENTRIES
7 -	LIST CONTENTS OF DATA BASE
8 -	PLOT DATA BASE ON SCREEN/PLOTTER/DISK
9 -	ISSUE DOS COMMANDS AND STAY IN GSMAP
10 -	EXIT TO DOS
ENTER CHOICE BY NUMBER:	

## MENU OPTIONS FOR GSMAP

### OPTION 1. START A NEW DATA BASE

Entering 1 from the Main Menu will begin operations to start a new data base. Each data base has four corners with coordinates entered at the time the data base is started; these corners are default corners used to index hard copy to the digitizer board. They set the default window on the screen for display of data, and can be used as the default plot area. For a data base using Cartesian coordinates the vertical direction is defined as the line between the corners on the left side of the map; the horizontal direction is perpendicular to the vertical. The scale in Y is determined by the distance between the upper left and lower left corner points; the scale in X by the distance between the line between the left two corners and the lower right corner point. For a data base using geodetic coordinates, the north-south direction is set by the principal meridian specified in the projection parameter file. X and Y scales are related to the scales of the copy and to the geometry of the map projection.

After selecting Option 1 from the Main Menu a message will provide the names of all .NDX files in the default area as a reminder of data base names already in use. Below this listing the first prompt requests:  
ENTER DATA BASE NAME: ?

This prompt requests the name that you wish to use for the data base of the map or illustration. If you enter a name that is already used by a data base a prompt will remind you:  
A DATA BASE WITH THE NAME OF \_\_\_\_ ALREADY EXISTS  
IF YOU RESPOND Y TO THE QUESTION THAT FOLLOWS YOU WILL  
LOSE ALL DATA STORED IN THE DATA BASE, SO BE CAREFUL!!!  
DO YOU WANT TO CONTINUE(y/N)?

If you answer N the prompt ENTER MAP DATA BASE NAME will return, prompting for entry of a different name. If you answer Y, the old data base will be overwritten, and the next prompt will be displayed. After entry of the name of the data base, the next prompt requests:  
IS THIS A GEODETIC OR CARTESIAN DATA BASE?(G/C):

Enter G=Geodetic or C=Cartesian. There is no default answer. The next prompt requests a title that will be associated with the map.  
ENTER TITLE:

This title is provided on listings of data and will be displayed on the Main Menu screen. Up to eight characters can be used for the map title of a geodetic data base, up to six for a Cartesian data base: more can be entered, but will not be recorded in the data base. After entry of the title the screen will prompt entry of information about the data base corners. This procedure is different for Cartesian and Geodetic data bases.

#### Cartesian coordinates

The following prompt starts the procedure for specifying corners for a new data base using Cartesian coordinates:

#### OPTIONAL METHODS FOR SPECIFYING DATA BASE CORNERS FROM DIGITIZER

1 ALL FOUR CORNERS  
FROM KEYBOARD

2 - SPECIFY UPPER RIGHT CORNER (X,Y)

3 - SPECIFY LOWER LEFT (X,Y), UPPER RIGHT(X,Y)

4 - ALL FOUR CORNERS

ENTER OPTION:

If Option 1 for defining the corners of the data base is selected by entering 1 at the prompt, the next prompt will request:

ENTER PLOT CONTROL FILENAME [DATABASE.PLT]:?

After entry of the complete name of the plot control file, including its extension, the screen will clear, and the next prompt (or prompts) will be:

ENTER EDIT DISTANCE [0.1]: Hit the ENTER key to accept the edit distance of 0.1" or enter a different number to select a different distance.

ENTER SNAP DISTANCE [0.05]: Hit the ENTER key to accept the default snap distance of 0.05" or enter a different snap distance. The prompt will change to:

ENTER 0 (ZERO) KEY ON CURSOR KEYPAD TO SYNCHRONIZE DIGITIZER INPUT

Follow this instruction by pressing the 0 key on the keypad of the digitizer with the cursor at any position in the active area of the digitizer. After synchronization of computer and digitizer the prompt on the screen will change to request entry of the first corner of the map on the digitizer. The prompts will be:

ENTER UPPER LEFT CORNER ON DIGITIZER:

ENTER LOWER LEFT CORNER ON DIGITIZER:

ENTER LOWER RIGHT CORNER ON DIGITIZER:

ENTER UPPER RIGHT CORNER ON DIGITIZER:

For these entries use the 0 key on the digitizer keypad to record the corner points in the sequence requested. During entry of the corner points, the cursor must be precisely located, with the cross-hair at the corner point being entered when the 0 key is pressed. UPPER, LOWER, LEFT, AND RIGHT apply to the map, not to the digitizer. The orientation of the map on the digitizer is not critical. Completion of the entering of the four corners from the digitizer returns operations to the Main Menu screen.

If option 1 is used the coordinates of the lower left point will be  $X=0$ ,  $Y=0$ , the upper left point will be at  $X=0$ ,  $Y$  = the distance in inches between the two left-hand points. The two right-hand corners will have  $X$  coordinates based on the distances from the line between the two left hand points, and  $Y$  coordinates based on the  $Y$  coordinates of the two right-hand points in the  $X,Y$  coordinate space defined by the left-hand points.

Options 2, 3, and 4 call for specification of numerical coordinates for data base corners from the keyboard. No digitizer is required. Option 2 creates a data base with the lower left corner coordinate value set to 0,0, the upper right at the  $X,Y$  values specified and upper left and lower right corners to create a rectangle. Options 3 and 4 allow specification of two or all four corners of a data base from the keyboard. Coordinates of data base corners have no units (e.g. inches), when entered; the scaling of the digitizing algorithm allows digitizing from a drawing at smaller or larger size, or one drawn in units different from those used to set up the data base. Use of options 2-4 allows digitizing into an existing orthogonal coordinate system such as a mine grid so that the  $X$  and  $Y$  coordinates of the digital data are recorded in the units of the mine grid system. Plotting sequences assume that the data base coordinates are entered in inches; plot scales must be adjusted accordingly.

After the data base corners have been established, operation will return to the Main Menu.

## Geodetic coordinates

Geodetic corner coordinates must be entered from the keyboard to start a data base. The format for entry of map corners is as follows: DD,MM,SS,C,DDD,MM,SS,C: Latitude in degrees, minutes, seconds, Compass direction (N or S), Longitude in degrees, minutes, seconds, Compass direction (W or E), with commas separating the entries, for example 38,30,0,N,106,15,0,W. For Compass direction use N for north latitude, S for south latitude, W for west longitude, E for east longitude .

The following prompt starts the procedure for specifying corners for a new data base using Geodetic coordinates:

### TYPES OF MAPS

- 1 - 7 1/12 MINUTE
- 2 - 15 MINUTE
- 3 - 30 MIN LAT x 1 DEG LONG
- 4 - 1 DEG LAT x 2 DEG LONG
- 5 - OTHER

ENTER TYPE:

Enter the number corresponding to the map to be used for digitizing. If type 1, 2, 3 or 4 is selected the following prompt will be seen:

ENTER LAT/LON OF NORTHWEST CORNER:

DD,MM,SS,C,DDD,MM,SS,C:

Entry of the required coordinates for the northwest corner of the map will return the screen to the Main Menu; coordinates for the other three corners of the data base will be computed by the program.

If type 5 is selected the following prompts will be seen, requesting entry of the latitude/longitude coordinates of the four corners of the map:

ENTER LAT/LON OF NORTHWEST CORNER

DD,MM,SS,C,DDD,MM,SS,C:

ENTER LAT/LON OF SOUTHWEST CORNER

DD,MM,SS,C,DDD,MM,SS,C:

ENTER LAT/LON OF SOUTHEAST CORNER

DD,MM,SS,C,DDD,MM,SS,C:

ENTER LAT/LON OF NORTHEAST CORNER

DD,MM,SS,C,DDD,MM,SS,C:

Completion of entry of the four coordinates in required form (commas separating the entries for degrees, minutes, seconds, and compass direction), returns operations to the Main Menu.



## OPTION 2: OPEN AN EXISTING DATA BASE

Entering 2 from the Main Menu of GSMAP will bring a screen listing the files in the default area with the extension .NDX, and a prompt at the bottom of the screen:  
ENTER MAP DATA BASE NAME:

Enter the name of the data base required. If the data base uses Geodetic coordinates, the latitude/longitude coordinates of the four corners of the database to be displayed on the screen; if a Cartesian data base, the corner coordinates will be in the X,Y coordinates chosen for the data base. The name of the data base, the coordinate system (Geodetic or Cartesian) and the title will be displayed. After checking this screen, pressing any key as instructed will return operations to the Main Menu.

If no data base with the name entered exists in the files in the computer's default area, a prompt requesting a valid data base name will be made:

AN ERROR HAS OCCURRED OPENING DATABASE (\_\_\_\_\_)  
CHECK DATABASE NAME. HIT ANY KEY TO RETRY

When this is displayed on the screen, hitting any key will cause the prompt requesting entry of a map data base to return to the screen. At the ENTER DATA BASE NAME prompt, hitting the Enter key will return operation to the Main Menu.

### OPTION 3. DIGITIZE NEW ENTRIES

Proper marking of the corner points on the hard copy used for digitizing is very important. Indexing of hard copy to the digitizer table requires that these points be readily identifiable and precisely locatable. One mark that is easily identified and very precise is a shallow cross cut with a knife blade in a mylar original; a plus mark made with a 9H pencil serves well for a paper original.

Be certain that the hard copy is firmly taped to the digitizer board. Use a magnifier on the cursor. **WARNING!** Errors will result if the hard copy moves on the digitizer after indexing it for digitizing. Fasten it so that it won't move. If it does move, go back to the menu and reopen the data base (option 2). Then properly index the copy to the digitizer. As long as a session within the same data base is continuous, re-indexing of hard copy to the digitizer tablet will not be required. Be certain that the hard copy is properly indexed to the digitizer whenever data is being digitized. Improperly digitized data almost certainly can't be "fixed", but must be deleted and the entries redigitized.

#### Input mode

At the start the program will select input mode. In input mode new data is entered into the data base using the digitizer. Before new data can be digitized, the cursor of the digitizer is used to provide the Code, P1 and P2 for the entry to be digitized. The uses of codes, the eight code groups, and the meanings assigned to Parameter 1 and Parameter 2 for each code group are described in the Reference section of this report. From the **INPUT** screen, entry of code=999 ends the digitizing session and returns execution to the Main Menu.

#### Edit mode

The edit mode is reached from the input mode by hitting the C key on the digitizer keypad. In the edit mode data already in the data base can be edited. Edit functions are as follows:

MOVE POINT	Moves one or more points of an entry to a new location
BREAK	Breaks a line into two segments.
CHANGE	Change parameters (CODE, P1, P2) for an entry
DELETE	Delete an entry or a point in a multi-point entry

The edit mode calls for especially careful scrutiny of on-screen messages; uses of keys will differ from one screen to another. Be careful. In the edit mode identification criteria for entries codes 1-99, 400-499, 600-699 700-799 and 800-899 include proximity to line segments defined by the points and to the digitized points; for codes 100-199, 200-299, 300-399, and 500-599, the only criteria is proximity to a digitized point (close to a leader line between its points doesn't count).

All data in the data base will be shown on the screen when digitizing. Codes in the plot control file will be displayed as specified. Codes that do not appear in the plot control file, will be plotted as lines or points in bright yellow. Lines and polygons outlines will be shown as solid lines without decoration or filling. The position of symbols and text will be indicated by a dot at each point digitized.

## Digitizing

Entering 3 from the Main Menu clears the screen, and opens the program for digitizing new entries and editing of existing data.

The first prompt will be:

ENTER PLOT CONTROL FILENAME (DATABASE.PLT): ?

Enter the name of the plot control file for the data base. The default plot control file, shown in brackets bears the name of the data base and the extension PLT.

The next prompt is:

ARE THE DATA BASE CORNERS THE REGISTRATION POINTS?(Y/n):

Enter Y or N. The default is Y. If the answer is N prompts will ask for entry of the coordinates of the corners to be used to index the hard copy to the digitizer. These prompts will be the same as those used to specify corners when starting a data base; follow the prompts and enter the required coordinates. After entry of the required coordinates, or if the answer to the prompt above was Y, After the Y entry, or answers to the data base coordinate prompts, the next prompt will ask:

ENTER FILENAME OF PROJECTION PARAMETERS (MAP.PRJ)?

This prompt will be skipped if Cartesian coordinates are in use.

The next prompt will be:

ENTER EDIT DISTANCE(0.1):

The "EDIT DISTANCE" is a distance in inches used in the edit sequence. Entries will be identified using the cursor as a pointing device; entries farther than the "edit distance" from the cursor when used to point out the entry will not be identified. The default value of 0.1 inches is shown within square brackets at the end of the prompt. Next the screen will prompt:

ENTER SNAP DISTANCE [0.05]:

GSMAP 9 implements the snapping of nodes (endpoints of lines) to achieve exact mathematical junctions. Endpoints closer together than the snap distance will be joined.

If the digitizer has not been indexed to the hard copy during the current session, the next prompt(s) will request:

ENTER 0 (ZERO) ON CURSOR KEYPAD TO SYNCHRONIZE DIGITIZER INPUT

Follow this instruction until the prompt changes to ask for entry of the four corners of the map from the digitizer keypad (use the 0 key). During synchronization the cursor can be at any point inside the active area of the digitizing table.

The prompts for indexing the map to the digitizer table for a data base using Cartesian coordinates are:

ENTER UPPER LEFT CORNER ON DIGITIZER:

ENTER LOWER LEFT CORNER ON DIGITIZER:

ENTER LOWER RIGHT CORNER ON DIGITIZER:

ENTER UPPER RIGHT CORNER ON DIGITIZER:

The prompts for indexing the map to the digitizer table for a data base using geodetic coordinates are:

ENTER NORTHWEST CORNER ON DIGITIZER:

ENTER SOUTHWEST CORNER ON DIGITIZER:

ENTER SOUTHEAST CORNER ON DIGITIZER:

ENTER NORTHEAST CORNER ON DIGITIZER:

Move the cursor to each corner in turn, and at each location use the 0 key on the keypad to index the corners of the map to the digitizer tablet.

The next prompt will provide information about the digitizing session underway, including the rotation of the copy in its current placement on the digitizer table, the scale, and correspondence between the dimensions of the corners of the copy and the ideal dimensions represented in the data base. An example is printed below:

ROTATION ANGLE=357.0937 DEGREES		
THEORETICAL DIST.	ACTUAL DIST.	DIFF.
4.32504	4.29953	0.02551
6.88816	6.86621	0.02195
8.11966	8.10009	0.01957
COMPUTED X SCALE=%10,003,667.426		Y SCALE= %10,049,061.298

CONTINUE? (Y/N)

The computer compares the the calculated distances between the SW (lower left) corner and the other three corners to check the match between the calculated points and the corner points entered on the digitizer to index the hard copy to the digitizer's coordinate system. If the X and Y scales differ by more than 2 percent, a message will be shown on screen, and a warning tone sounded:

SCALE DIFFERS BY MORE THAN 2 % IN X AND Y

CONTINUE? (y/N)

An answer must be provided from the keyboard of the computer. N (no) or use of the ENTER key will return you to the menu screen. Y (yes) will allow you to proceed. This message calls for careful checking of all parameters entered into GSMAP and checking the hard copy being digitized. If no scale problem is identified after digitizing the fourth corner point and a Y answer is given to the CONTINUE Y/N prompt, data in the data base will plot on screen. After all data have been plotted, digitizing can proceed with entry from the keypad of the digitizer, starting with entry of the code desired for the first entry to be digitized. If you wish to proceed directly to digitizing without screen display hit the F9 key, then the Q key, and operation will proceed directly to the input screen as shown below.

Input mode

INPUT

KEY DEF.

A=END FLD  
 B=WINDOW  
 C=CH.MODE  
 D=DUPLIC  
 E=RESTART  
 F=EDIT DS  
 O=POINT  
 1=END  
 2=END POL  
 3=END INT  
 999=EXIT

All data in the data base will be plotted on the screen unless you abbreviate plotting using the F9 Q keystroke sequence. The instruction line at the bottom of the screen will be

ENTER CODE

The bottom line furnishes instructions. It will first call for code, then entry of P1, then entry of P2. Enter each in turn. After entry of CODE=CODE, P1=P1, and P2=P2 for the entry to be digitized, the entry number, code, P1 and P2 will be displayed on the right side of the screen, e.g.

ENTRY	10
CODE	25
P1	0
P2	0

Prompts direct the three entries made from the keypad digitizer before entering data points: Code, 1-3 digits (if less than 3, the "A" key is used to complete this entry).

Parameter 1 (P1), 0-6 digits (if less than 6, the "A" key is used to complete this entry)

Parameter 2 (P2), 0-6 digits (if less than 6, the "A" key is used to complete this entry)

During entry of CODE, P1, and P2 from the keypad three tones will be sounded, C, F, and finally A (low, medium, and high). The A=440 Hertz indicates that the system is ready for digitizing a data point.

The prompt on the instruction line of the screen will change to:  
**ENTER POINTS**

When entering data points, the 0 key, 1 key, 2 key and 3 key are used. Each key has specific uses, see p. \*\*. Instructions for digitizing entries in each of the eight code groups are given in the Reference Section.

The E key can be used to reset the prompt to ENTER CODE if a mistake is made during the process of entering CODE, P1, P2 and during the digitizing of an entry.

If you wish to change the edit distance, hit the F key at the ENTER CODE prompt. A prompt will instruct you to digitize two points separated by the desired Edit Distance. The prompt is:  
**ENTER TWO POINTS AT DESIRED DISTANCE APART**

If you wish to view a part of the area of the plot using the entire screen. hit the B key on the keypad. Prompts will request entry of the lower left, then the upper right corner of the area to be viewed. The specified area will then be displayed on the full screen.

### Edit mode

To enter the Edit Mode hit the C key when the system is ready for entry of CODE. The screen will clear and change to the screen shown below:

EDIT  
SELECTION  
CRITERIA  
---by---  
CODE  
---or---  
A

B = WINDOW  
C = REFRESH  
D = PREV  
E = RESTART  
F = EXIT

After all data has been plotted on the screen the instruction line will change to:  
**ENTER CRITERIA:**

Enter the CODE of the entry you wish to edit (the CRITERIA for selection called for by the prompt), or A for ALL. The instruction line at the bottom of the screen will change to:

### IDENTIFY ENTRY

Move to a point on the entry to be edited, press the 0 key. The program will identify an entry (this may take some time if the data base is large). After the entry is identified (and on EGA or VGA color monitors highlighted in bright white), Entry number, CODE, P1, P2 and the number of points for this entry will be displayed below the instructions on the right side of the screen and the prompt will call for confirmation that this is indeed the entry to be edited.

ENT 13  
P1 0  
P2 0  
PTS= 181

### ENTER C (ACCEPT) OR ANY OTHER (REJECT)

Enter C if the proper entry has been identified, or hit another key if the entry is not the one desired. This procedure allows selection of the desired entry, even if coordinates are coincident (as for example a line coincident with the boundary of a polygon). After the desired entry has been identified and accepted (C) the screen will change as below:

## EDIT FUNCTIONS

A = MOVE PT  
B = BREAK  
C = CHANGE  
D = DELETE  
E = EXIT

ENT 13  
P1 0  
P2 0  
PTS = 146

### ENTER FUNCTION:

Enter the function you wish to perform, e.g., B to break a line into two segments, by hitting the key on the keypad identified in the list on the right side of the screen. The messages on the right side of the screen and prompts on the last line of the screen will be dependent on the edit function selected. These provide instructions at all steps of the program and must be followed carefully. If you identify a point to be moved or deleted on a line (or other multi-point entry), cursor lines will be added to the screen display of the line). Using the A and B keys you can move along the points of the line so that you can be sure that the point is correctly identified.

Move from one screen (or function) to another, using the E key to move back in sequence, and by following prompts to move forward. Entry of F from the edit screen returns operation to the INPUT mode, entry of 999 as the selection criteria ends the digitizing session and returns execution to the Main Menu.

Careful attention to screen plotting and use of the F9 and Q keys on the keyboard to stop screen display as early as practical will greatly reduce the time required for editing of large data bases.

For example, hit the F9 Q sequence immediately after changing to the edit mode, then window a small part of the map (see next page), let the screen plot build only until needed entries are displayed, then terminate the screen plot using the F9 Q sequence, and proceed with editing. It takes far less time to plot the small part of a map on the screen defined by a window than the entire data base. But don't be too impatient. Wait for the screen prompts to change and don't work ahead, or both you and the program can get confused.

DIGITIZING - USES OF KEYS ON THE MULTI-KEY KEYPAD  
Non-numeric Keys INPUT MODE

**A** The **A** key - COMPLETE - is used only to complete entries of CODE, P1, and P2, prior to digitizing of data points. Its function is to COMPLETE entry of CODE, P1, or P2 or to enter the value 0 and simultaneously complete the entry.

**B** The **B** key - WINDOW - is used to reset the area shown on the screen during the process of entering data points (to set a new window). Entry of a **B** (the cursor can be anywhere within the active area of the digitizer), followed by a 0 at the lower left (southwest) corner of the window desired, followed by a 0 at the upper right (northeast) corner of this window, will reset the area shown on the screen for the current session of the program. All lines in the windowed area will be shown on screen. Resetting the window is most useful when examination of details in a small part of the map is needed.

**C** The **C** key - CHANGE is used to change from digitizing (INPUT MODE) to the EDIT mode at the point in operations when the computer is waiting for input of a CODE.

**D** The **D** key - DUPLICATE - is used to set CODE, P1 and P2 to the same values as those of the previous entry. When the digitizer is ready for input of the code, hitting the **D** key will provide immediate setting of the three entries to the settings used for the previous entry. If the **D** key is used just after opening a database, default values of 1,0,0 will be set for CODE, P1, and P2. Use of the **D** key can greatly speed digitizing.

**E** The **E** key - ESCAPE - is used to recover from mistakes made during keypad entry. At any time during digitizing of an entry, hitting the **E** key will return the system to the starting point for entering the CODE for the next entry. Information from the partially completed entry will not be added to the database; this avoids the necessity of completing a defective entry during digitizing. The **E** key performs this function from the start of entry of the CODE until the digitizing of data for an entry has been completed by a stroke of the 1 or 2 key.

**F** The **F** key is used in the input mode to reset the Edit Distance; it is used to change from Edit mode to Input mode.

Non-numeric keys edit mode

In the edit mode, the functions of the alpha keys differ from those in the input mode and change from screen to screen. Attention to on-screen messages is mandatory. The edit screens provide prompts for the uses of the alpha keys.



#### Numeric keys input mode

During entry of CODE, P1, and P2, the numbered keys on the keypad are used to enter their numerical value. During digitizing of data points the 0, 1, 2, 3, and 4 keys are used for digitizing points. Each of these keys has specific and different functions.

**0** The 0 (zero) key sends the X,Y coordinates of the point at the cross hair of the cursor to the computer.

**1** The 1 (one) key sends the X,Y coordinates of the point at the cross hair of the cursor to the computer, **AND** closes the entry.

**2** The 2 (two) key sends the X,Y coordinates of the point at the cross hair of the cursor to the computer, **AND** causes the computer to add another point at the end of the data string with X,Y coordinates identical with the first point of the data string for that entry (thus closing a polygon exactly, **AND** closes the entry).

**3** The 3 (three) key sends the X,Y coordinates of the point at the cross hair of the cursor to the computer, **AND** causes the computer to add another point at the end of the data string with X,Y coordinates identical with the first point of the data string for that entry (thus closing the polygon exactly), but does not close the entry. It is used during digitizing of polygons to close a polygon but leave entry of points open so that another polygon (e.g. internal polygon), can be digitized into the same entry. The 3 key should only be used with 400-499 codes.

#### Edit mode

In the edit mode, any key can be used to identify points and move points. For certain functions a specific key is required; these will be identified by on-screen instructions.

## DIGITIZING USING A ONE-KEY CURSOR: THE MENU TEMPLATE

GSMAP Version 9.0 supports use of a single key on the digitizer cursor by using a menu template 2 inches square (see below) to specify function to the computer. Tape the map to be digitized securely to the digitizer board. Tape the template securely to the digitizer board outside the map area and square the template with the sides of the board (close is good enough). The appropriate CONFIG9.DIG file specifying "MENU" mode must be used.

0	1	2	3
4	5	6	7
8	9	A	B
C	D	E	F

Figure 1. Menu template for use with a one-key cursor.

## Use of the Menu Template

The use of the menu template is described below. As an example, to digitize new entries:

Select Option 3 (DIGITIZE NEW ENTRIES) from the Main Menu: enter 3 from the keyboard. Prompts will tell you what to do at each step. Move the cursor to the points requested and press any key as prompted:

ENTER LOWER LEFT CORNER OF MENU ON DIGITIZER  
ENTER TOP RIGHT CORNER OF MENU ON DIGITIZER

ENTER UPPER LEFT CORNER OF DRAWING ON DIGITIZER  
ENTER LOWER LEFT CORNER OF DRAWING ON DIGITIZER  
ENTER LOWER RIGHT CORNER OF DRAWING ON DIGITIZER  
ENTER UPPER RIGHT CORNER OF DRAWING ON DIGITIZER

The cursor is next used as a pointing device to specify CODE, P1, and P2 for the entry to be digitized. To select CODE=10, move the cursor to a point on the menu template inside the circle labeled 1, then depress a key, then move inside the circle labeled 0, depress a key, then move inside the "A" circle, then depress a key to complete entry of code, next inside the "A" circle hit a key to enter P1=0, finally, inside the "A" circle tap a key to enter P2=0.

With CODE, P1, and P2 specified, the digitizer is now used to digitize data points. Move to the points required, use a key to digitize the points required in turn. After the last point of the line, move the cursor inside the "1" circle, then hit a key to complete the entry. The line will be plotted on the screen, and the system will be ready for entry of the CODE for a new entry.

Uses of numeric "circles" during digitizing of data: Digitize data points (equivalent to 0 key), after completing this sequence, move to the menu template and use the cursor to indicate the meaning of the last point digitized (e.g. to the 2 circle to close a polygon.

- 1 The "1" circle is used like the 1 key on a multi-key keypad to end digitizing of an entry.
- 2 The "2" circle is used like the 2 key on a multi-key keypad to close a polygon and end digitizing of the entry.
- 3 The "3" circle is used like the 3 key on a multi-key keypad to close a polygon without ending digitizing of the entry.

Uses of alphanumeric "circles" during entry of CODE, P1, and P2:

- A The "A" circle is used to complete entry of CODE, P1, P2
- B The "B" circle can be used at the point when entry of CODE is required to set the system for windowing from the keypad. After the "B" is entered, move the cursor to the lower left corner of the window to be set, then hit a key, then move to the upper right corner of the window, then hit a key.
- D The "D" circle can be used at the point when entry of CODE is required to set CODE, P1, and P2 to the values for the previous entry.
- E The "E" circle can be used at any time during digitizing of an entry to return the system to the point of entry of a CODE.

Ending a digitizing session:

End the digitizing session by entering CODE=999 (move the cursor inside the "9" circle and tap a key three times.

### Option 3, input mode, new text

A special feature in GSMAP that can be used when digitizing entries with 500-599 and 700-799 codes permits addition of single lines of text to the text file with minimum disruption to the digitizing session. If a 500-599 or 700-799 code is defined in the plot control file (and consequently a text file exists), if you wish to digitize a single-line text entry not defined in the text file, enter the code at the **ENTER CODE** prompt, enter P1=0, enter P2 at the size you wish, e.g. 60. a prompt will request:  
**ENTER TEXT:**

Use the keyboard of the computer to type the desired text (displayed on the bottom line of the screen, don't type a line too long to fit the available space), digitize the point or points to locate the text in the diagram. GSMAP can't find #0 in the text file, so it lets you add a line to the existing file, and tells you the number of the text in the text file so that you can use the text again.

### OPTION 4. DELETE ENTRIES

Entry of 4 from the Main Menu of GSMAP enables deletion of individual entries by specifying their entry number. Deleted entries are not removed from the data base, and so may be recovered later if needed. Deleted entries will not be plotted on the screen or on the plotter.

Selection of option 4 brings the prompt:  
**ENTRY# TO DELETE (0 TO QUIT):?**

Enter the number of the entry to be deleted. The entry will be deleted, and the prompt **ENTRY# TO DELETE (0 TO QUIT):?** prompt will be repeated. Entry of 0 or hitting the (ENTER) key instead of a valid entry number returns the program to the Main Menu.

### OPTION 5. RECOVER ENTRIES

Entry of a 5 from the Main Menu of GSMAP enables a deleted entry to be recovered. The first prompt is:  
**ENTRY# TO RECOVER (0 TO QUIT):?**

This prompt requests the number of the entry to be restored to the active data base, and will be repeated until you have recovered all desired entries, at which point entry of 0 instead of a valid entry number or hitting the (ENTER) key causes operations to return to the Main Menu. Follow the prompts. If you attempt to undelete an entry that has not been deleted, the screen will let you know, and prompt the next step.

#### OPTION 6. CHANGE PARAMETERS OF AN ENTRY

Entry of a 6 from the Main Menu of GS MAP enables change of Code, Parameter 1, and Parameter 2, for a single entry or globally for all entries belonging to a single code. Such changes might be needed to modify the size of lettering, plotting characteristics, character of lines, or to correct errors made during digitizing. The global option permits changing CODE, P1, or P2 for all entries in the data base with a particular code. Entries are prompted from the screen. The first prompt:  
Global Change ?(y/N/q)?

Entry of Y allows you to make changes to all entries with a specified code in the data base. You can change the CODE, P1, or P2, or all three one-at-a-time. The default to this prompt is N. Entry of Y causes the following prompt to appear:  
CODE TO BE CHANGED:?

Entry of the number of the code brings another prompt:  
CHANGE CODE (CODE), P1(P1), P2(P2)?

Example:  
entry of CODE brings a prompt for entry of the code to be changed. The prompt:  
NEW CODE:?

Requests entry of the new code. After entry of the new code, the system returns to the initial prompt:

Global Change ?(y/N/q)?

Entry of N or hitting the (ENTER) key will start a series of prompts: enter the information requested.  
ENTRY# TO BE CHANGED (0) TO QUIT:

This prompt calls for the number of the single entry to be changed. On-screen information will be supplied showing the "old" code and parameters 1 and 2 for the entry, and will request the desired "new" parameters - For example:  
OLD PARAMETERS= 1 0 0  
ENTER NEW VALUES, (CODE,P1,P2):

Entry of the desired code, the value of parameter 1, and the value of parameter 2 (separated by commas) causes the requested changes in the database, and a return to the prompt:  
ENTRY# TO BE CHANGED (0) TO QUIT:

At this prompt entry of a 0 causes return to the prompt:  
Global Change ?(y/N/q)?

Entry of a Q returns execution of the program to the Main Menu.

## OPTION 7. LIST CONTENTS OF DATA BASE

Entry of 7 from the Main Menu will provide a listing of information for entries in the data base, either on the screen, or on the printer, as specified. If the option for screen display is chosen, the display will pause after display of 20 entries. During the pauses, the prompt "HIT ANY KEY TO CONTINUE, Q TO QUIT" is displayed. Hitting the Q key during one of the pauses will cause return to the Main Menu. The F9 key can be used to return to the main menu during the scrolling of the screen display. Entry numbers and the word DELETED will be shown for deleted entries. A screen prompt begins the listing process:  
PRINT ON SCREEN OR PRINTER (S/p):

Entry of S (screen) or P (printer) as desired (the default is S) is followed by message on the last line of the screen:  
FUNCTION KEY 9 TO PAUSE, Q TO QUIT, RETURN TO CONTINUE

Information supplied in the listing includes:

Data base name, title, date, number of entries, and coordinates of the corners of the data base.

The next prompt requests entry of the code for data desired:

ENTER LINE CODE(-1 FOR ALL, 0 TO QUIT)

Entry of the desired code or -1 to see all entries) will provide a listing, like the following, on the screen or printed, as previously specified. This prompt will be repeated to permit listing of data for all codes desired.

```
DRAW (01-08-1992 07:46:55)
EXERCISE      NO. ENTRIES= 60
UL      -0.000      4.325 ---- UR      6.852      4.357
LL      0.000      0.000 ---- LR      6.888      0.016
ENTRY CODE  P1      P2      NO.PTS
              X/Y      FIRST PT              X/Y      LAST POINT
  36  201    345      3      1
              .7401185631  1.553923249      .7401185631  1.553923249
NO. OF ENTRIES OF THIS TYPE = 1
```

The code-by-code listing provides:

Entry number, P 1, P2, latitude and longitude or X and Y coordinates of the first and last points of each entry, and the number of points in the entry, and after the last entry in the data base of code requested, the number of entries of the code specified.

If you wish to find out the codes of deleted entries, request a listing specifying each code in turn. All entries of the code will be listed (deleted entries will be so labeled).

Entry of 0 instead of a code returns operations to the Main Menu.

## OPTION 8. PLOT DATA BASE ON SCREEN/PLOTTER/DISK

Entry of 8 from the Main Menu starts the plotting sequence. Plots can be drawn on the screen, on a plotter, or written to a disk using the Hewlett Packard Graphics Language (HPGL). Projection parameter files for geodetic data bases and plot control files should be ready before starting GSMAP. It is good practice to make sure that the plotter is ready and loaded with paper and pens before entering the plot sequence. The prompts for plotting are very simple. The interactive plotting sequence of previous versions of GSMAP is not offered in the current version because of the need for plot control files to improve graphics during digitizing, as well as to make plots on the screen and on the plotter.

If a geodetic data base is being plotted, the first prompt requests the name of the projection parameter file (see p.93 for examples of these files). Files with the extension .PRJ in the active area will be listed on the screen. This prompt will be skipped if Cartesian coordinates are being used.  
ENTER FILENAME OF PROJECTION PARAMETERS(DATABASE.PRJ)?

Enter the full name of the Projection parameter file that you wish to use or hit the ENTER key to use the default file with name shown in the prompt between parenthesis marks. The next prompt is:  
SCREEN,PLOTTER,DISK? (S,p,d,pr):

The response specifies a plot on the screen S, on the plotter P, or a disk file D, or on a plotter registered to a pre-marked sheet in the plotter PR. The default is S (plot to the screen). Enter your choice. The screen will then display a list of files in the active area with the extension PLT, and the prompt:  
ENTER PLOT CONTROL FILENAME (DATABASE.PLT): ?

Enter the name of the plot control file; the default has the name of the data base and the extension PLT unless a different plot control file has been specified during the current session. Enter the complete name of the file, including extension. The plot control file will be shown briefly on the screen. The error checking functions of GSMAP will make sure that codes are valid (1-799), that pens numbered 1-15 are specified, and that the format of the file matches the expectations of the program. If there is an error, the rapid scrolling of the plot control file down the screen will stop and an error message will help locate the problem. Usually the error will be located within the last two lines of the file shown on the screen. If all is well, the screen will change, show the size of the map and ask if you wish to continue.  
MAP SIZE(X,Y)= 7.00 14.00  
DO YOU WANT TO CONTINUE?(Y,N):

Enter Y if all is well, N if you wish to return to the main Menu; the default is Y. If you enter Y the next prompt will ask:  
DO YOU WANT TO DRAW CORNER BRACES?(y/N):

If you want the plot corners drawn, enter Y, the default is N. After this response has been entered the next prompt will ask:  
DO YOU WANT INTERNAL TICK MARKS?(y/N):

If you respond Y the next prompt will ask for the spacing of the tick marks. If a Cartesian data base the prompt will be:  
ENTER DELTA (INCHES):

A similar prompt for a geodetic data base will require entry in degrees, minutes and seconds. After this response, or if you respond N, if you are plotting to the screen, the program will operate and display the data called for.

If P was entered to the prompt SCREEN,PLOTTER,DISK? (S,p,d,pr):  
to select the plotter the next prompt will be:

PLOTTER SHOULD BE TURNED ON AND PAPER LOADED!!!!  
HIT ANY KEY WHEN READY

If **D** was entered to the prompt  
SCREEN,PLOTTER,DISK? (S,p,d,pr):

A series of prompts requesting information about the disk file to be used and scaling points for the plot will be displayed.

ENTER DISK FILENAME:

Enter the complete file name with extension for the file to be used to store the HPGL commands: The next prompt asks for entry of the values for the scaling points.

ENTER scaling points, P1X,P1Y,P2X,P2Y:

Scaling points P1 and P2 are discussed in the documentation for each plotter. The values of scaling points depend on the kind of plotter and on the size of the plot media; there are no default values.

Values for scaling points are provided, see p. \*\*.

For example

Scaling points For the HP 7550A plotter, A size paper 8 1/2"x 11".

P1x,P1y	P2x,P2y
80,320	10080,7520

If the plot is rotated swap values for P1x with P1y and P2x with P2Y, e.g.

320,80	7520,10080
--------	------------

Enter the values required, e.g. **80,320,10080,7520** (values for 8 1/2"x11" paper with the HP 7550A plotter. Entry of these values brings the prompt:

HIT ANY KEY WHEN READY

Hit any key to proceed. After completion of the plot, a prompt will provide opportunity to plot the corners specified in the plot control file.

DO YOU WANT TO DRAW CORNER BRACES?(y/N):

Answer Y or N, the default is N. The next prompt will be:

DO YOU WANT INTERNAL TICK MARKS?(y/N):

Answer Y or N, the default is N. If you specify Y a prompt will call for the spacing desired.

In Cartesian coordinates the prompt will be: ENTER DELTA (INCHES):

If the data base uses geodetic coordinates the prompt will be: ENTER DELTA (DD,MM,SS)

Enter the spacing desired e.g. **1** for a one inch spacing of tick marks in Cartesian coordinates, or e.g. **0,30,0** for a 0 degree, 30 minute, 0 second spacing in geodetic coordinates. After entry of the spacing, tick marks will be drawn. The plot sequence is over. Hit any key to return to the Main Menu.

### Plot Register **PR**

**PR** must be entered in response to the prompt SCREEN,PLOTTER,DISK? (S,P,D,PR): if you want to register a plot to specific locations of **data base corners** already marked on a pre-loaded sheet in the plotter. To do this precisely a digitizing sight is required. For approximate registration, a pen can be substituted. .



Prompts will be displayed as for the plotter **P** option above.

Prompts will call for responses about corner brackets and grid points. Respond as appropriate. HPGL data will be written to a file so that it can be scaled for plotting after indexing to the hard copy.

The next prompt will call for insertion of the digitizing sight into the plotter's pen holder in position #1.

**INSERT DIGITIZING SIGHT IN PEN POSITION 1  
HIT ENTER KEY ON KEYBOARD WHEN READY**

After the digitizing sight loaded into position #1 of the carousel hit the enter key. A message will be added to the screen:

**HIT PEN UP KEY ON PLOTTER TO LOAD DIGITIZING SIGHT.  
MOVE SIGHT TO APPROXIMATE POSITION OF NW CORNER USING PLOTTER CONTROLS.  
HIT PEN DOWN, MOVE TO EXACT POSITION OF NW CORNER, DIGITIZE BY HITTING ENTER  
KEY ON PLOTTER  
HIT ENTER ON KEYBOARD TO CONTINUE**

move the digitizing using controls on the plotter to the NW corner (Upper Left if Cartesian coordinates), using plotter controls. When the sight is very near the NW corner hit the **PEN DOWN KEY** on the plotter, move it to the exact position of the corner, hit the **ENTER** key on the **PLOTTER**. This indexes = digitizes the NW corner. Next, hit the **ENTER KEY** on the **KEYBOARD** of the computer to proceed.

Prompts will next call for indexing the SW and SE corners in turn. Follow the prompts as described above for indexing = digitizing the each corner in turn.

**DIGITIZE SW CORNER  
HIT ENTER ON KEYBOARD TO CONTINUE**

**DIGITIZE SE CORNER  
HIT ENTER ON KEYBOARD TO CONTINUE**

**REMOVE DIGITIZING SIGHT AND REPLACE WITH PEN  
HIT ANY KEY TO CONTINUE**

Remove the digitizing sight and replace it with the pen that belongs in the pen #1 position in the carousel.

The plotter will operate, produce the plot in the position indexed on the sheet. When finished operation will return to the Main Menu.

The **PR** option makes use of an HPGL file, one created on the active drive, then used for plotting, then deleted. For this reason, make sure that the active drive has space available. For example, the HPGL file for Plate 1 and another for a completely patterned 15' quadrangle exceed a Megabyte in size. A fast drive is very desirable.

The **PR** option will modify the scales specified in the plot control file so that the plot will match the indexed copy. The sizes of all elements including the 200-299 codes will change. Modify the scales indicated in the plot control file appropriately. These scale changes hold true for plots from geodetic data bases using the **PR** option as well as for Cartesian data bases.

## GSMAP Plot Control Files

GSMAP plot control files are used for plotting to the screen, to a disk, and to the plotter, and for digitizing so that text and symbology can be shown on the screen. Up to 500 codes may be referenced in one plot control file. The same plot control files are also used by the GSMEDIT program, GSMPBLD, and GSMPBS. These files select corners, provide plotter parameters, select entries for plotting, and control all graphical aspects of plotting. These plot control files can be written using any text edit program that produces an ASCII file without embedded characters (used as control characters for printing by many programs). Almost all of the standard word processing programs can produce or export such a file. Some of the terms used for entries are discussed below.

### Offsets

Offsets XOFF and YOFF are used to move the entire plot to a new place on the plot media. The desired X offset and Y offset are entered in decimal inches to position the illustration. The X and Y offsets are measured in inches from the lower left corner, Y vertical, X horizontal, and increasing from this corner. The offsets, XOFF, YOFF, are separated by a comma when entered.

### Draft mode

In Draft Mode GSMAP, the entry number will be plotted to the left of the first digitized point for each entry and a small circle is drawn around the first and last points of each line. If Draft Mode is not specified, entry numbers and circles will not be plotted, in effect constituting the publication mode.

### Rotation

Rotation is a plotter feature calling for a 90 degree rotation of a plot on the plotter media. Check the plotter manual for rotation instructions. In most cases if the X dimension of the plot exceeds the Y, rotation should not be specified.

### Speed and force

Speed and force are plotter characteristics. Pen speed is specified in cm/sec, force by integers 1 to 8 that set the downward force. Optimum speed and force depend on pen type and plot media. Examples of settings and default settings provided by Hewlett-Packard (in parentheses) for one type of pen are given here. The quality of final plots generally is improved by slowing the pen speed.

		Force values = grams	
PEN TYPE	SPEED cm/sec	FORCE values	
Fiber	25 (50)	1 (2)	1 = 10 g
			2 = 18 g, 3 = 26 g

### Width and height

The width and height of the characters which will be used as the labels of entry numbers in draft mode is specified in inches in the CONFIG9.PLT file (0.04,.06 are good values to use); values of .03,0.045 produce characters of about the smallest legible size. Width and height values are required in the fourth line of the plot control file for codes 100-199.

### Plot corners

Plot corners other than the data base corners for Cartesian data bases can be set by entering a N as the first line of the plot file, and specifying the X and Y coordinates of the plot window in the next four lines of the plot file. The format of these lines is X,Y; the values are the X and Y values for the desired plot corners using the coordinate system of the data base. If a map has been digitized in coordinates other than inches, remember to set scales accordingly or plots may not have the sizes expected.

Plot corners other than the data base corners for geodetic data bases can be set by entering a N as the first line of the plot file, and specifying the latitude and longitude coordinates of the plot window in the next four lines of the plot file. The format of these lines is latitude in degrees,minutes,seconds,Compass direction, longitude in degrees,minutes, seconds, Compass direction, see example on p. 29.

### Example of Cartesian plot control file

Comments to the right outside the box are annotations, not a part of the file.

Entry in Plot Control File	Comments
Y	Use data base corners as plot corners
1,1	X,Y scales
1,2	X,Y offsets
N	Draft mode=N
Y	Rotate=Y
12,2	Speed=12, Force=2
1,1,0,0, "SOLID LINE CONTACTS use 00 pen"	Code=1, Pen=1, Line type=0,0,=No decoration
4,5,0,0, "SOLID LINE FAULTS use 1 pen"	Code=4, Pen=5, Line type=0,0,=No decoration
400,1,0,0, "Igneous rocks, solid fill"	Code=400, Pen=1, Line type=0,0,
1,0.01,0,1,0	Fill type=1, spacing=.01", Angle=0, Alt pen=1, Alt LT=0
401,2,0,0, "Alteration"	Code=401, Pen=2, Line type=0,0,
1,06,45,2,0	Fill type=1, spacing=0.06", angle=45, Alt pen=2, Alt LT=0
555,1,0,0, "ROCK UNIT LABELS"	Code=555, Pen=1, Rotate letters=0, Rotate words=0
FILENAME.TXT,0	File with rock unit labels, Font#=0
1,1,1,0, "dotted line contacts"	Lines
201,2,0, "DIP & STRIKE SYMBOLS"	Code=201, Pen=2, Line type=0,0,
101,3,0,0, "SYMBOLS with POSTING"	CODE=101, Pen=3, Line type=0,0,
DRAW.DAT,2	File containing data for 101 Code, Font#=2
0.04,0.06	Width=0.04", Height =0.06" of posted characters
300,2,0,0, "SYMBOLS"	Code=300, Pen=2, Line type=0, Rotate=0
N	Randomize=N
701,1,0,0, "Map title"	Code=701, Pen=1, Line type=1,0,
DRAW.TXT,3	File containing text for 701 Code, Font#=3
0,0,0,0,	End of the plot file

.LH8

### Example of a geodetic plot control file

If you wish to use the corners of the data base as plot corners, enter Y in the first line of the plot file and omit the next four lines specifying plot corners.

Entry in plot control File	Comments
N	Plot corners are specified below.
39,0,0,N,106,0,0,W	Lat/Lon NW corner
38,0,0,N,106,0,0,W	Lat/Lon SW corner
38,0,0,N,104,0,0,W	Lat/Lon SE corner
39,0,0,104,0,0,W	Lat/Lon NE corner
500000,500000	X,Y scales
0,0	X offset=0, Y offset=0 (inches)
N	Draft mode=N
Y	Rotate=Y
25,1	Speed 25, Force 1
1,1,0,0, "CONTACTS"	Code=1, Pen=1, Line type=0,0,=No decoration
4,5,0,0, "FAULTS"	Code=4, Pen=5, Line type=0,0,=No decoration
400,1,0,0, "IGNEOUS ROCKS STIPPLE&OUTLINE"	Code=400, Pen=1, Line type=0,0,
4,0.001,0,3,1	Fill type=4, space 0.001", Angle=0, Alt pen=#3, Fill LT=1
401,2,0,0, "ROCK ALTERATION FILL&OUTLINE"	Code=401, Pen=2, Line type=0,0,
4,0.05,45,2,0	Fill type=1, space 0.05", Angle=45, Alt pen=1", Fill LT=0
555,1,0,0, "rock unit labels"	Code=555, Pen=1, Letter slant=0, Word slant=0
FILENAME.RU,0	FILENAME.RU contains text, Font#=0
501,1,0,0, "NAMES OF MINES"	Code=501, Pen=1, Letter slant=0, Word slant=0
FILENAME.TXT,2	FILENAME.TXT contains text, Font#=2
6,1,1,0, "CONCEALED CONTACTS"	Code=6, Pen=1, Line type=1,0=No decoration
300,2,0,0, "SYMBOLS"	Code=300, Pen=2, Line type=0, Rotate=0
N	N Don't randomize orientation
0,0,0,0,	End of the plot file

Notes at the end of the plot file following the 0,0,0,0, end of file line should be used to explain the contents, e.g.

PLOT FILE, 1:50,000 SCALE FOR DATA BASE=FILENAME

Example of a geodetic plot control file, asterisks used to prevent plotting of selected codes

If you wish to use the corners of the data base as plot corners, enter Y in the first line of the plot file and omit the next four lines specifying plot corners.

Entry in plot control File	Comments
N	Plot corners are specified below.
39,0,0,N,106,0,0,W	Lat/Lon NW corner
38,0,0,N,106,0,0,W	Lat/Lon SW corner
38,0,0,N,104,0,0,W	Lat/Lon SE corner
39,0,0,104,0,0,W	Lat/Lon NE corner
500000,500000	X,Y scales
0,0	X offset=0, Y offset=0 (inches)
N	Draft mode=N
Y	Rotate=Y
25,1	Speed 25, Force 1
1,1,0,0, "CONTACTS"	Code=1, Pen=1, Line type=0,0,=No decoration
*4,5,0,0, "FAULTS"	Do Not Plot Code=4
*400,1,0,0, "IGNEOUS ROCKS STIPPLE&OUTLINE"	Do not plot Code=400
*4,0.001,0,3,1	
401,2,0,0, "ROCK ALTERATION FILL&OUTLINE"	Code=401, Pen=2, Line type=0,0,
4,0.05,45,2,0	
*555,1,0,0, "rock unit labels"	Do not plot Code=555
*FILENAME.RU,0	
501,1,0,0, "NAMES OF MINES"	Code=501, Pen=1, Letter slant=0, Word slant=0
FILENAME.TXT,2	FILENAME.TXT contains text, Font#=2
6,1,1,0, "CONCEALED CONTACTS"	Code=6, Pen=1, Line type=1,0=No decoration
300,2,0,0, "SYMBOLS"	Code=300, Pen=2, Line type=0, Rotate=0
N	N Don't randomize orientation
0,0,0,0,	End of the plot file

Asterisks have been used in column one of the plot file above so that the selected codes will not plot (GSMAP and GSMEDIT. All lines pertaining to each code must be labelled, not just those beginning with a code.

#### OPTION 9. ISSUE DOS COMMANDS AND STAY IN GSMAP

Option 9 allows you to stay in a working session using GSMAP without affecting registration of hard copy to the digitizer table, yet copy files to the working area, operate a word processing program to revise a plot control file, or perform other DOS functions (programs without great demands on core memory).

The prompt is:

ENTER DOS COMMAND FOLLOWED BY A RETURN (RETURN ONLY TO EXIT)?

Type the DOS command, then hit the ENTER key. Hit the space bar as requested, the ENTER key to return to the Main Menu.

DOS commands such as COPY, DIR, DEL, TYPE will function as expected.

The DOS command PRINT will send the file to a print buffer, not to the printer; this uses a part of the core memory of the computer. Subsequent GSMAP operations options (such as plotting a data base) may fail, providing the error message "Out of memory in line 0 of module ..... Hit any key to return to system". The printer will print a copy of the requested file after operation returns to DOS (after you leave GSMAP). If you want a printout of a short file such as a plot control file, TYPE the file (to the screen), then print the screen using the Shift PrtSc keys.

Version 9 releases enough memory that small word processing programs can be used.

#### OPTION 10. EXIT TO DOS

Entry of a 10 from the Main Menu will end the session in GSMAP and return operation of the system to the DOS prompt.

## REFERENCE SECTION

### LINE TYPES

Line types (patterns) are defined by the GSMAP program Version 9. Definitions of patterns are contained in the ASCII file CONFIG9.PLT and can be modified by the user. Line types are specified by number, 0-17, 98, and 99. Lines can be decorated with any of the symbols in the symbol set evenly spaced along the line or only at digitized points. Symbols have been used to decorate some of the lines below. Line type 99 is a phantom trace (no line is drawn), that can be decorated with symbols, as shown below using symbol 116, spacing 0.15 to generate a shear pattern. Line type 98 generates two lines, one on each side of the digitized line; the two parallel lines are useful when representing highways. The distance from the digitized trace (no line plotted) to the lines on each side of it is specified when plotting (the example drawn here uses a splined line). If a negative spacing is specified for a decorated line, symbols are drawn at digitized points (don't use a splined line).

#### Line types SYSTEM 9

0	_____	
1	.....	7
2	-----	8
3	-----	9
4	-----	10
5	-----	11
6	-----	12
		13
		14
		15
		16
		17

Line type 99, symbol 116

~~~~~

Line type 98



Symbol 122 size=50

-----

Symbol 122 size=100

-----

Symbol numbers, decorated lines

|     |       |
|-----|-------|
| 101 | ----- |
| 102 | ----- |
| 110 | ----- |
| 111 | ----- |
| 122 | ----- |
| 150 | ----- |
| 231 | ----- |
| 110 | ----- |
| 108 | ----- |
| 106 | ----- |

Figure 2. Standard line types and examples of decorated lines with symbol numbers.

# STANDARD SYMBOLS

































































































































|                                                                                     |     |                                                                                     |     |                                                                                     |     |                                                                                     |     |                                                                                       |     |
|-------------------------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------------------|-----|
|    | 200 |    | 202 |    | 221 |  | 222 |    | 208 |
|    | 201 |    | 203 |    | 205 |  | 206 |    | 207 |
|    | 214 |    | 215 |    | 210 |  | 212 |    | 213 |
|    | 220 |    | 223 |    | 216 |  | 218 |    | 219 |
|    | 229 |    | 230 |    | 224 |  | 225 |    | 228 |
|    | 237 |    | 238 |    | 233 |  | 234 |    | 236 |
|    | 243 |    | 244 |    | 239 |  | 240 |    | 242 |
|    | 249 |    | 250 |    | 245 |  | 246 |    | 248 |
|    | 255 |    | 256 |    | 251 |  | 252 |    | 254 |
|    | 261 |    | 262 |    | 257 |  | 258 |    | 260 |
|    | 267 |    | 268 |    | 263 |  | 264 |    | 266 |
|    | 101 |    | 108 |    | 109 |  | 110 |    | 106 |
|  | 102 |    | 122 |    | 114 |  | 111 |    | 117 |
|  |     |  |     |    |     |  |     |    | 150 |
|  | 1   |  | 2   |  | 3   |  | 4   |  | 5   |
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|  | 37  |  | 38  |  | 39  |                                                                                     | 40  |  | 36  |
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|  | 62  |  | 74  |  | 75  |  | 76  |  | 61  |
|                                                                                     |     |  |     |  |     |  | 77  |  | 78  |

Figure 3. Standard symbols defined in the file CONFIG9.SYM drawn at a size of 100, 0 degree rotation.

## FONTS

Version 9.0 provides six fonts. The keyboard characters are shown below. Characters in the extended character set (ASCII 129-255 for fonts #0, #1 and #2 are shown on the next page. Font #0 includes the special geologic characters as used in previous versions of GSMAP. Font #0 is the default font used if a font is specified that is not present in the default area. All fonts (including special characters) can be used with code groups 100-199, 500-599, and 700-799.

|          |                                                                                                                                                    |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Font # 0 | ABCDEFGHIJKLMNOPQRSTUVWXYZ<br>abcdefghijklmnopqrstuvwxyz<br>1234567890=[ ]' ', .€/<br>! ¤# \$% ^ & * ( ) _ + " ' :<br>~   < > ?                    |
| Font # 1 | ABCDEFGHIJKLMNOPQRSTUVWXYZ<br>abcdefghijklmnopqrstuvwxyz<br>1234567890=[ ]' ', . \/<br>! @ # \$ % ^ & * ( ) _ + { } :<br>~   < > ? "               |
| Font # 2 | ABCDEFGHIJKLMNOPQRSTUVWXYZ<br>abcdefghijklmnopqrstuvwxyz<br>1234567890=[ ]' ', . \/<br>! @ # \$ % ^ & * ( ) _ + { } :<br>~   < > ? ;               |
| Font # 3 | ABCDEFGHIJKLMNOPQRSTUVWXYZ<br>abcdefghijklmnopqrstuvwxyz<br>1234567890=[ ]' ', . \/<br>! @ # \$ % ^ & * ( ) _ + { } :<br>~   < > ? "               |
| Font # 4 | <i>ABCDEFGHIJKLMNOPQRSTUVWXYZ</i><br><i>abcdefghijklmnopqrstuvwxyz</i><br>1234567890=[ ]' ', . \/<br>! @ # \$ % ^ & * ( ) _ + { } :<br>~   < > ? " |
| Font # 5 | <i>ABCDEFGHIJKLMNOPQRSTUVWXYZ</i><br><i>abcdefghijklmnopqrstuvwxyz</i><br>1234567890=[ ]' ', . \/<br>! @ # \$ % ^ & * ( ) _ + { } :<br>~   < > ? " |

Figure 4. Examples of keyboard characters in fonts supplied with Version 9.0, from top to bottom, #0=Gothic augmented with the special geologic characters, #1=Gothic, #2=Roman Duplex, #3=Roman Triplex, #4=Script simplex, #5=Roman Duplex Italic.

Extended character set

Font #0

ASCII#

Character plotted

128 Ç

129 ü

130 é

131 â

132 ä

133 å

134 ä

135 ç

136 ø

137 ë

138 è

139 í

140 î

141 ï

142 Ä

143 Å

144 É

145 æ

146 Æ

147 ö

148 ø

149 ð

150 ü

151 ÿ

152 Ö

153 Ø

154 ç

155 £

157 ¥

158 ℞

159 ƒ

160 ó

161 í

162 ó

163 ü

164 ü

165 ü

166 ü

167 ü

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169 ü

170 ü

171 ü

172 ü

173 ü

174 ü

175 ü

176 ü

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## SYSTEMATIC DESCRIPTIONS OF CODE GROUPS

Nine code groups are used, each with specific functions. Use of these code groups is summarized below and discussed in more detail on subsequent pages. Codes are assigned during digitizing based on functional requirements for plotting.

### Code Group:

#### 1-99

Lines and lines decorated with symbols. Digitized points will be connected with straight line segments when plotted.

#### 100-199

Symbols and posting of data associated with the symbol locality from row/column ASCII files. The first point defines the location of the symbol, an optional second point provides an alternate position for posting numbers or alphanumeric characters (new to GSMAP 8.0).

#### 200-299

Individually rotatable symbols such as strike and dip symbols. Each code is used for a specific symbol rotated according to the number entered as P1. These symbols are drawn at a size of 100 rasters.

#### 300-399

User defined codes for symbols. Codes are selected by the user, the number of the symbol is entered as P1, the size of the symbol in units of 1/1000 inch is entered as P2.

#### 400-499

Polygons. Closed figures that can be patterned when plotted.

#### 500-599

Alphanumeric characters drawn from ASCII files. Used for multi-line entries, entries with leaders (the first point digitized determines the location of text; subsequent pairs of points define leaders).

#### 600-699

Splined lines. Lines will be smoothed during plotting by a curve-fitting algorithm that honors all digitized points.

#### 700-799

Alphanumeric characters drawn from ASCII files. Only single-line entries. No leaders. One-point digitizing locates text just as for the 500-599 codes. Two-point digitizing sets location and slope of text. 3-5-point digitizing defines a line; characters in entry are evenly spaced along this line. Digitizing of 6 or more points defines a line; characters are evenly spaced along a splined line defined by these points.

#### 800-899

Polygons. Closed figures that can be patterned when plotted. The functions of this code group are exactly the same as those of the 400-499 codes. These codes were added to Version 8.0 so that a total of 200 different polygon codes would be available.

## LINES AND DECORATED LINES - CODES 1-99

Codes 1-99 are assigned by the user to various kinds of lines. All lines are digitized as if solid. Patterns, line weights, and/or decorations are specified for entries of each code when plotting. Enough different codes should be used to accommodate needed patterns, line weights, and decorations and combinations of pattern, weight, and decoration. Use of some regular convention for codes for common kinds of lines will aid digitizing and plotting. One convention easily remembered is to use codes 1, 2, and 3 for fine solid, dashed, and dotted lines (contacts), 4, 5, and 6 for heavy solid, dashed, and dotted lines (faults). We suggest reserving codes 1-15 for geologic lines. Code special lines such as area outlines, using higher numbers. If thrust faults and other lines with asymmetric decorations are always digitized so that the "teeth" are on one side in the direction of digitizing, a single code is needed, rather than two. We recommend keeping all decorations on the right side of the line in the direction of digitizing (the right-hand rule).

### Digitizing

Three entries from the digitizer keyboard are required:

1. CODE: user defined on the basis of the kind of line desired.
2. P1=0, Enter A.
3. P2=0, Enter A. If the line is to be decorated, enter the size of the symbol to be used to decorate the line. If 0 is specified, a default size of 100 will be used for the decorating symbol.

After entry of CODE, P1, and P2, if the system uses the multi-button cursor, digitize the line using the 0 key to digitize points up to the last or next to last point. The 1 key is used to end the line at the last point digitized. The 2 key is used to digitize the next to last point and then add the first point of the entry as the last point of the entry. This closes the line, thus defining the border of a closed polygon.

A single line (entry) can contain as many as 5000 points. Experience will assist in answering the question "how many points are needed?" The factors to consider will include the curvature of the line, the kind of line (dotted lines require fewer points than solid lines), and the scale of the plot relative to the scale of the digitizing. The plotter connects the digitized points with straight line segments. Start and end lines at natural points such as branches or intersections, just as a draftsman would. These minimize plot defects caused by pen starts and stops.

## Plotting

Plot files for codes 1-99 generally require one line consisting of four entries separated by commas. Plots of decorated lines also require a second set of two entries to specify the spacing desired for the decorating symbols and the pen to be used for the decorations (alternate pen). Each set is specified on one line of a plot control file.

The first set provides:

CODE, PEN NUMBER, LINE TYPE, 0 (or the symbol number for decorated lines), e.g. 12,5,0,0,.

Entry 1: the code specified (1-99) as defined by the user and specified for each entry during digitizing, then a comma (,), e.g. 13,

Entry 2: the pen number, a number from 1-6 or 1-8 depending on the number of pens in the plotter's carousel, then a comma (,), e.g. 5,. Pen numbers 1-15 can be used when plotting to the screen to make use of all of the colors provided by EGA and VGA color graphics systems. Be careful to restrict pen numbers to those actually in the carousel when using the plotter.

Entry 3: the line type, a number 0-18, 98, or 99, then a comma (,), e.g. 0,. Figure 2 provides for sample plots of the standard line types.

Entry 4: 0 for all lines without decorations; for thrust faults and other "decorated" lines the appropriate symbol number should be used. The number must also be followed by a comma (,) e.g. 0,. Comments enclosed between quotation marks are essential parts of the file to record the use of different codes. A carriage return is required at the end of this entry.

The second set provides specifications for decorated lines; it's not used for undecorated lines:

SPACING BETWEEN SYMBOLS, ALTERNATE PEN NUMBER, e.g. 0.15,3.

Entry 1: The spacing in inches is followed by a comma.

Entry 2. Alternate pen. The number of the pen that will be used to draw the symbol used to decorate lines codes 0-12. Entry 2 is not used for line type 98 (parallel lines).

These two entries constitute the second set. The first symbol will be plotted at a distance of 1/2 the spacing distance, subsequent symbols at spacings along the line equal to the spacing interval. The symbol on a decorated line will be rotated during plotting to preserve a constant angular relationship between the symbol and the line. If **LINE TYPE 99** is specified no line will be plotted, but this phantom trace can be decorated. Any symbol can be selected and spaced at specified intervals (SPACING) along this phantom trace. If line type 98 is selected no line will be plotted at the digitized position but parallel lines will be plotted on both sides of the digitized trace at the spacing distance specified (the width between the lines will be twice the spacing distance specified).

To decorate a line with symbols at digitized points, specify a negative spacing value (any value) and the alternate pen to be used for plotting symbols as set two for the entry (the second line for the entry in the plot file). The size of the symbol will be the numeric value set as P2 in the data base. The size of the symbol will be 100 if the value for P2 is 0 or 100. If you wish a symbol of different size, change the value of P2 in the data base to the size desired.

## SYMBOLS AND POSTING OF TABULAR DATA - CODES 100-199

Codes 100-199 are used to plot symbols and post associated tabular data drawn from ASCII row-column files near the symbol. Data files must be formatted as in the following example:

Locality number, value 1, value 2, value 3, etc. A table might look like the sample below. This file contains a locality number column and four data columns (for four records). This example is from a geochemical study; the data columns represent values in ppm for Cu, Mo, Pb, and Zn. Every column must contain a value for each row. If data is missing for a column, put in a comma, or " " (double quote blank double quote). The computer must find an entry for each column in every row. Be careful to observe the format for the data table, especially checking to see that the commas separating the columns are in place. Don't use characters such as commas and semicolons within the columns, because these are delimiters in Basic and will be interpreted as column breaks.

The first column is used for the locality identifier; succeeding columns are used for data pertaining to this locality. The first column is restricted to numbers. Alpha and numeric characters can be used in the other columns. Commas (,) must be used to separate the columns.

```
410, 50, 10, 100, 105
411, 15, 2, 20, 106
414, 30, 50, 150, 107
416, 70, 10, 300, 500
```

### Digitizing

Three entries are required from the digitizer keypad:

1. CODE, (100-199) Select according to symbols required. Symbol types and sizes are selected for each code when plotting.
2. P 1: Locality number. Any number containing up to 6 digits, followed by an A to complete P1 if less than 6 digits.
3. P 2: Angle of rotation of plotted posting, in degrees measured counterclockwise from the horizontal, completed with the A key. Use of the A key alone sets the P2 value to 0. This value selects horizontal posting to the right of the digitized point. **Angles between 91 and 269 degrees cause posting of numbers to the LEFT of the locality point, angles 270-360, 0-90 degrees plot to the RIGHT of the point, see Fig. 6.**

Entries can be digitized using one or two points (new to Version 8):

One point: the 1 key is used to digitize the point. Move the cursor to the exact point required, press the 1 key. The system will record the point, then return for entry of the CODE for another entry.

Two points: If you wish to use the capability of Version 8 to specify an alternative posting position, digitize the principal location with the 0 key, then close the entry by digitizing the posting position with the 1 key.

## Plotting

Plot control files for codes 100-199 require four sets of entries. Each set is specified on a separate line of a plot control file.

The first set answers provides:

CODE,PEN NUMBER, LINE TYPE, SYMBOL NUMBER e.g. 101,1,9,50.

Entry 1: Code (100-199), then a comma (,)

Entry 2: the pen number, then a comma (,)

Entry 3: the number of the symbol desired defined in the CONFIG9.SYM file, then a comma (,)

Entry 4: the size of the symbol desired in 1/1000 inch, followed by a comma (,). Comments enclosed in quotation marks are desirable.

The second set provides:

FILENAME FOR DATA FILE, FONT # e.g. DRAW.DAT,1.

Entry 1: enter the complete name of the file, including extension followed by a comma, then the number of the font to be used, e.g. DATA.DAT,2 .

The third set, provides:

# COLUMNS IN DATA TABLE, # OF COLUMN TO BE PLOTTED e.g 3,1.

Entry 1: the number of columns of data in the table (not including the locality number column)

Entry 2: the number of the data column containing the data that is to be plotted; if 0 is specified, the locality number will be plotted, 1 will cause data from the first (left) column of data to be plotted, 2, the next column to the right, and so on.

The fourth set, provides:

Entry 1: the width of posted characters, height of posted characters in inches e.g. 0.04,0.06 (no comma follows).

Posting will be done with a space between the symbol and the adjacent number equal to the half the symbol size specified plus the width specified for the label characters. The size of the numbers used for posting will be the size specified in the fourth set. An example is provided in the file on p. 29.

If no symbol is wanted, specify symbol 30 (symbol 30 has no pen down moves) and no symbol will be plotted. If a symbol is wanted without posting, substitute a blank space then a comma, then 0 (zero) in the plot control file at the place appropriate for the data file name and font number. Specify that the file has one data column and request plotting from column 1. If locality numbers are wanted without the bother of creating a data file, use any non-blank character, then ,0 (e.g. A,0) followed by a carriage return as the second entry in the third set (FILENAME FOR TABLE, column to be plotted. Specify that the table has 1 data column, and that you wish column 0 plotted. The program will read the locality number entered as P1 in the database, and plot this number in the appropriate place.

The plot below illustrates some of the capabilities of code group 100-199. Locality numbers on the left side near open square symbols were plotted without using an ASCII data file (CODE 101 below); the numbers represent the value for P1. The sample numbers near filled squares use alternate posting positions, (CODE 100), + symbols and alphanumeric identifiers were taken from data column #1, ASCII file named 100.SAM, CODE 103. Alphanumeric identifiers (CODE 104) illustrate posting without plotting a symbol (use of symbol #30). Numbers near filled circles (CODE 102) specify the angle specified as P2 to illustrate different positions for posting of data. Triangular symbols without numbers (CODE 105) illustrate another choice that is available when plotting.

Data file 100.SAM for Figure 6:

```
1,"RT-87-101",101, 50
2,"RT-87-102",102, 60
3,"RT-87-103",103, 70
4,"RT-87-104",104, 90
```

Plot control file for Figure 6:

```
Y
1,1
0.1,3
N
Y
12,2
100,1,4,50,
100.SAM,0
3,3
0.04,0.06
101,1,3,70,
100.SAM,0
3,0
0.04,0.06
102,1,2,50,
100.SAM,0
3,0
0.04,0.06
103,1,9,50,
100.SAM,0
3,1
0.04,0.06
104,2,30,50, "POSTING ONLY"
100.SAM,0
3,1
0.04,0.06
105,3,5,50, "SYMBOLS ONLY"
,0
1,1
0.04,0.06
0,0,0,0, "END OF FILE"
```

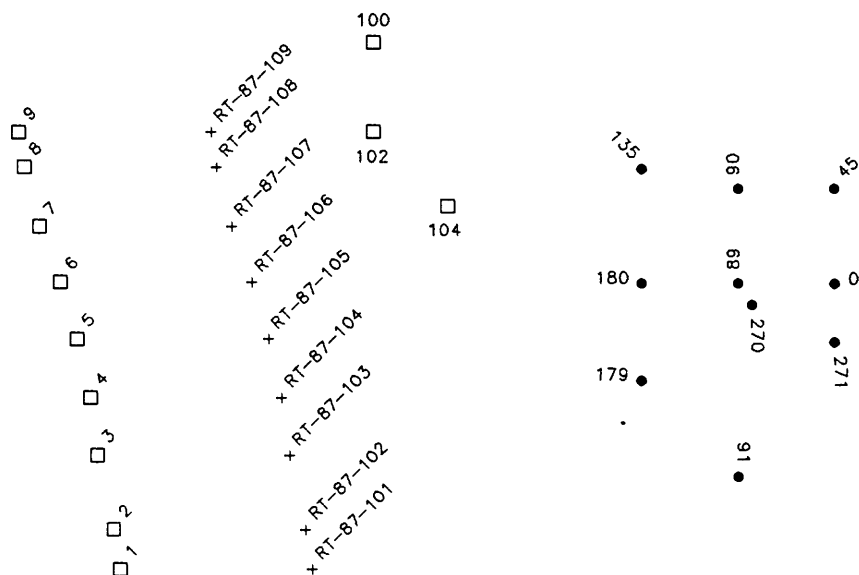


Figure 6. Posting of tabular data using 100-199 codes. Values next to filled circles correspond to the rotation angle entered as P2.

## INDIVIDUALLY ROTATABLE SYMBOLS - CODES 200-299

Codes 200-299 are used for individually rotatable symbols. Unlike other code groups, each code in this group has a specific use. Each code specifies a single specific symbol. Symbols that are included in the standard CONFIG9.SYM file are shown on fig. 3 with postings in the default position.

### Digitizing

Three entries from the digitizer keypad are required:

1. CODE: the code of the desired symbol.
2. P 1: the angle of rotation of the symbol in degrees, measured in a clockwise direction from north (Geodetic) or vertical (Cartesian), followed by an A.
3. P2: the angle of dip or plunge (degrees) to be posted, followed by an A. If no angle is required for the symbol chosen, enter A.

One-point digitizing (used when the angle of rotation of the symbol is known):

The position of the symbol is digitized by pressing the 1 key at the location desired. Rotation of the symbol during plotting uses this point as its axis. Most symbols, including strike and dip, foliation, anticline symbol, and syncline symbol rotate from the center of the symbol. The bar and ball rotate from the end to be plotted on the fault trace; lineation symbols rotate from the end of the symbol away from the point of posting. The position of this point has been chosen to assist its use and match standard practice.

Two-point digitizing (used to digitize accurately plotted symbols; the angle of rotation is calculated by the program:

After entry of Code (200-299), P1=0 (use A key), enter P2=angle to be posted, then digitize location of the symbol with the 0 key, then following the right hand rule (to properly rotate the symbol), digitize a second point with the 1 key. This point sets P1 to the angle of azimuth measured by the two digitized points. It's a quick way to digitize a carefully plotted symbol. To help establish the second point to be digitized, visualize the symbol with 0 degree rotation as plotted on fig. 3; put the second "up" on the symbol. In tests of two-point digitizing, the azimuth of small symbols was calculated within 1.5 degrees of the plotted value.

Digitizing, whether using the one-point or the two-point procedure will enter two points with identical coordinates into the data base (mew to Version 9). If a posting position other than the default position is required, the second point can be moved to select an alternate posting position. This editing is best accomplished using GSMEDIT, but can also be done using the edit mode of GSMAP.

## Plotting

Plots of each symbol type, codes 200-299, require one set of four entries from the keyboard. During plotting in the interactive mode, prompts will request all entries. Each code is specified on one line of a plot control file.

The set provides:

CODE, PEN NUMBER, 0, 0,

Entry 1: the CODE specifying the particular symbol type to be plotted, followed by a comma (,).

Entry 2: the pen number, followed by a comma (,).

Entry 3: 0, followed by a comma (,).

Entry 4: 0, followed by a comma (,). Comments may be added after the final comma and are an essential part of a plot control file.

The size of symbols codes 200-299 is set by the program and does not change as a function of the scale of the plot with both geodetic and Cartesian coordinates. Fine tip pens must be used or the numbers that are posted, (e.g. the angle of dip)B will not be legible. The size of the posting can be modified by changing specifications in the CONFIG9.SYM file. Rotatable symbols with or without posting of numbers can be added to the CONFIG9.SYM file using unassigned numbers in the range 200-299.

Editing to select alternate posting positions without changing the position of the symbol from the point of observation can only be done if two points have been digitized for the symbol. This is done automatically by Version 9 of GSMAP and GSMEDIT. A second point can be added to symbols codes 100-199 and codes 200-299 for single point entries in data bases created using previous versions of GSMAP using Options 2 and 4 of GSMUTIL, first creating an ASCII file, then converting this file back to a data base. This procedure is described in the documentation for GSMUTIL, Version 9.



## USER-DEFINED SYMBOLS - CODES 300-399

Codes 300-399 are used for symbols. The user defines the use of each code. The kind and size of each symbol can be specified during digitizing. During plotting all symbols of a particular code can be rotated by a specified angle (as a group). The orientation of symbols can be "randomized"; that is, each symbol differently rotated using a random number generator. The instructions to the plotter that define symbols are contained in the file named CONFIG9.SYM; additions to this file are easily made, see p. 91.

### Digitizing

Three entries from the digitizer keypad are required:

1. CODE: user defined, on the basis of pen to be used, and rotation desired in plotting.
2. P1: symbol number, see fig. 3 for standard set.
3. P2: symbol size in units of 1/1,000 inch.

Move the cursor to the point desired. If a single symbol is desired, the 1 key should be used. If a number of the same kind of symbol with the same size and rotation are desired, digitize the points using the 0 key up to the final point, where the 1 key should be used to end the entry.

Most symbols are centered at the central point. For example, symbol 13 is centered at the crossing point of the pick and hammer. However, the digitized point for symbol 11 is at the top of the symbol. This is the point placed at the digitized point.

### Plotting

Plots of symbols and symbol groups, codes 300-399, require two sets of entries; each set is specified on one line of a plot control file.

The first set provides:

Code, Pen number, 0, 0,

Entry 1: the CODE specified by the user followed by a comma (,).

Entry 2: pen number, followed by a comma (,).

Entry 3: 0, followed by a comma (,).

Entry 4: the angle in degrees (+ clockwise) that all symbols of this code are to be rotated, assuming that rotations are not randomized, followed by a comma (,). Comments may be added after the final comma and should be a part of every plot control file.

The second set provides:

Randomize orientation Yes= Y or no= N:

Entry 1:

N or Y

N will cause all symbols of this code to be rotated by the angle specified in Entry 4 of the first set. Y will cause symbols digitized as a single entry to be rotated at random angles based on a random number calculated by the computer. Although the random number generator is "random" in one sense, it always uses the same series of "random" numbers - like a printed random number table if you always start at the same place. Sequential plots will have the same symbols rotated by the same amount.

With Cartesian coordinates symbols are sized according to their size in the data base but sizes are modified according to the scale of the plot in X (not Y). For example, a symbol of size=100 would be plotted at a size of 50 on a plot with XSCALE=0.5 (half-sized plot). For a geodetic data base symbols are plotted at the sizes specified in the data base regardless of plot scale.

## POLYGONS AND FILLS - CODES 400-499 and 800-899

Codes 400-499 and 800-899 are used for closed polygons so that their interior can be patterned during plotting. The area is outlined as a closed area during digitizing. Fill types (types of patterns) and the kind of line to be used are specified when plotting.

### Digitizing

Three entries from the digitizer keypad are required:

1. CODE: user defined, on the basis of fill pattern desired. Polygons to be filled with different patterns should be coded differently.
2. P1: 0. Use the A key.
3. P2: 0. Use the A key.

The outline of the polygon is digitized using a series of 0 key entries until the last point before closing. This next-to-last point may be digitized using the 2 key, which records the point and closes the polygon, or with the 0 key, then the last point with the 3 key which closes the first (external) polygon but leaves the entry open so that internal closed polygons can be added. Internal polygons are digitized with a series of 0s, and closed with the 3 key, except for the last internal polygon which must be closed with the 2 key. When plotted, these internal polygons will be left as unfilled "windows" inside the filled polygon. No more than 5,000 points can be digitized to define both exterior and interior polygons for a single entry.

## Plotting

The seven fill types used by GSMAP Version 9 are specified by a number 0-6:

- 0 -- A line outlines the polygon without fill (patterning).
- 1 -- A set of parallel lines fill the polygon (no outline).
- 2 -- Two sets of mutually perpendicular parallel lines (a grid) fill the polygon (no outline).
- 3 - Symbols of type and size specified by the user will be drawn on horizontal lines spaced at user defined intervals (Y DELTA), at a spacing specified by the user (X DELTA) (no outline).
- 4 -- A set of parallel lines fill the polygon, and the border of the polygon will be drawn.
- 5 -- Two sets of mutually perpendicular parallel lines (a grid) fill the polygon and the border of the polygon will be drawn.
- 6 - Symbols of type and size specified by the user will be drawn on horizontal lines spaced at user defined intervals (Y DELTA), at a spacing specified by the user (X DELTA), and the border of the polygon will be drawn.

Examples of plot control files containing 400-499 codes are provided, see p. 47. Each set of entries described below occupies one line of the plot control file.

For all fill types (0-6), the first set of entries is:

Set number 1:

Entry 1: the CODE, a number (between 400 and 499) followed by a comma (,).

Entry 2: the pen number for the outline, followed by a comma (,).

Entry 3: the line type for the outline followed by a comma (,).

Entry 4: 0 followed by a comma (,). Decorated lines can not be used. Comments enclosed in quotation marks follow the last comma to provide clues as to the use of the code.

For fill types 0, 1, 2, 4,5 the second and last set of entries specify parameters for the fill, parallel lines, or grid, pen number for the fill pen, and the line type to be used for the fill.

Set number 2:

Entry 1: the fill type, a single digit number, 0, 1,2,4,5, followed by a comma.

Entry 2: the spacing between fill lines in inches followed by a comma. For **solid** fills a spacing of 0.01 inches works with all b  
Use 0 for fill type 0.

Entry 3: an angle in degrees followed by a comma. This entry specifies the angle measured from the horizontal (+ counterclockwise, - clockwise) for the direction of the lines (first set of grid for fill types 2 and 5). Use 0 for fill type 0.

Entry 4: The number of the pen used for the fill followed by a comma. For fill type 0 specify 1 (not 0 because 0 is not a possible pen number).

Entry 5: The number of the line type used for the fill pattern, use 0 for fill type 0 a comma is not used to end this entry.

For fill types 3 and 6, specifying symbols plotted at grid points:

The second set of three is:

Entry 1: the fill type, a 3 or 6 followed by a comma (,).

Entry 2: X DELTA (the spacing in X (horizontal) entered as the spacing between symbols in inches, followed by a comma.

Entry 3: Y DELTA (the spacing in Y (vertical) entered as the spacing between lines of symbols in inches. this angle is followed by a comma.

Entry 4: Alternate pen number (pen used for fill) followed by a comma.

Entry 5: Line type for fill lines, this entry is not followed by a comma.

The third and final set of entries for fill types 3 and 6 consists of:

Entry 1: the number of the symbol as defined in the CONFIG9.SYM file followed by a comma.

Entry 2: the symbol size measured in 1/1000 inch followed by a comma.

Entry 3: a Y or N. Y specifies that the orientation of the symbols is to be randomized. N specifies a rotation of 0 degrees for all symbols, this entry is not followed by a comma.

All of the entries are required. For example, pen and line type for the fill must be specified for fill type 0 (outline, no fill) even if logic might seem to dictate otherwise, that's the way computers are, but it makes changing parameters for fill types in plot control files easier as all of the entries are present. Do not attempt to fill polygons unless they have been closed during digitizing. If you do, the results are more apt to be amusing than useful. The effect of a stipple pattern is obtained by using fill type 1, line type 1 and a spacing of 0.03 inch, or line type 7 and a spacing of 0.06 inch for a more widely spaced stipple.

Plot file used to plot Figure 7.

```

Y
1,1.1
-1.40,2.0
N
Y
8,2
100,1,30,0,
EMPTY.SAM,2
1,0
0.06,0.08
400,1,0,0, "Polygon 1"
0,0,1,1,0
401,1,1,0, "Polygon 2"
1,.03,00,1,0
402,1,0,0, "Polygon 3"
2,.040,0,2,2
403,1,0,0, "Polygon 4"
3,0.09,.06,1,0
109,60,Y
404,1,0,0, "Polygon 5"
4,.03,90,2,0
405,2,0,0, "Polygon 6"
5,0.030,45,1,2
406,1,0,0, "Polygon 7"
6,.08,.08,1,0
9,35,N
407,1,0,0, "Polygon 8"
2,0.05,45,1,0
408,3,0,0, "Polygon 9"
4,.015,0,2,13
409,1,0,0, "Polygon 10"
6,0.07,.06,1,0
48,60,Y
410,1,0,0, "Polygon 11"
3,.10,.10,1,0
11,90,Y
411,3,0,0, "Polygon 12"
5,.02,45,1,0
412,1,0,0, "Polygon 13"
4,.030,0,2,1
413,1,1,0, "Polygon 14"
6,0.07,.06,1,0
117,60,Y
0,0,0,0,
GSMAP VERSION 9
EXAMPLES OF FILLS

```


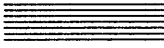




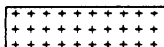


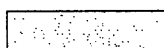
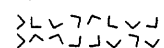


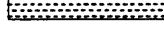
|                                                                                     |    |
|-------------------------------------------------------------------------------------|----|
|    | 1  |
|    | 2  |
|    | 3  |
|    | 4  |
|   | 5  |
|  | 6  |
|  | 7  |
|  | 8  |
|  | 9  |
|  | 10 |
|  | 11 |
|  | 12 |
|  | 13 |
|  | 14 |

Figure 7. Examples of polygon fills (patterns). Parameters can be varied by the user to produce different patterns from the basic fill types.

## CODES 500-599

### ALPHANUMERIC ENTRIES - WORDS, LETTERS, NUMBERS, AND A FEW SPECIAL CHARACTERS

Codes 500-599 are used for alphanumeric entries. The letters and numbers to be plotted are entered into an ASCII data file that will be called by its file name during plotting, and plotted according to the positions digitized. The selection of codes is based on, 1) pen needed for plotting, 2) slant angle for letters (block letters or italics), and 3. the angle that the character, word, or block of text is to be rotated on the page. Separate groups of text entries accordingly using different codes. 500-599 codes should be used for text if multi-line entries are needed or if leaders are needed, as for rock unit labels on geologic maps. Codes 700-799 are also used for alphanumeric entries. These codes cannot be used for multi-line entries and leaders for entries cannot be entered. 700-799 codes are more efficient if the angle of the words is to be varied or if letters are to be spaced along a digitized line.

#### Digitizing

Three entries from the digitizer keypad are required:

1. CODE: user defined on the basis of pen, slant of letters and words desired in plotting. Any code numbered between 500 and 599 can be used.
2. P1: the number of the entry to be placed on the plot corresponding to the number for the entry in the ASCII data file.
3. P2: the size of the lettering, expressed in units of 1/1000 inch.

The first point digitized, using either the 0 or the 1 key positions the text block or character. The digitized point locates the lower left corner of the first character in the block of text.

- If the 1 key is used, the entry is complete.
- If the 0 key is used, the block of text is placed, and succeeding points positioned by using the 0 and the 1 key define straight-line leader between the two points, and complete the entry.
- Multiple leaders can be drawn. Use the 0 key for all but the final point. Points 2 and 3, 4 and 5 (etc.) will be connected to draw leaders.

If the plot control file does not include the code specified or the text file doesn't exist, or include number specified as P 1, the screen will show the position of the point digitized and the leader(s) but not the words or characters that will be plotted. If the code is included and the specified text file includes the number required, the text will be drawn on the screen in the Font specified.

## Plotting

Plots of codes 500-599 require two sets of entries. During plotting in the interactive mode, prompts will request all entries. Each set is specified on one line of a plot control file.

The first set provides:

CODE, PEN NUMBER, 0 (or slant angle of letters), 0 (or slant angle of words),:

The first set is:

Entry 1: the CODE desired, a number between 500 and 599, followed by a comma (,).

Entry 2: the pen number, followed by a comma (,).

Entry 3: the slant angle for letters (an angle measured clockwise from the vertical see Fig. 8); 0 degrees for block lettering, about 30 degrees for simulated italic letters, followed by a comma (,).

Entry 4: the angle of rotation for blocks of text on plot (an angle measured from the horizontal, + counterclockwise, - clockwise, see Fig. 8), followed by a comma. Comments may be added after the final comma and should be a part of a plot control file.

The second set. Two entries supply the name of the file containing the text and the number of the font to be used:

FILENAME.TEXT, # of FONT

Entry 1: the name of the file containing the data to be plotted, followed by a comma (,). This entry must contain the complete filename with its extension.

Entry 2. the number of the font desired.

Slant angle  
of LETTERS



Slant angle  
of WORDS

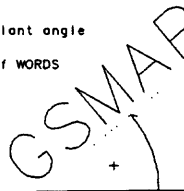


Figure 8. Examples of slanted letters and rotated words.

The text rotates around the initial digitized point during plotting. When using Cartesian coordinates the size of the lettering that will be plotted varies with the scale of the plot in X (horizontal), e.g. a half-sized plot, XSCALE=0.5, will have letters half the size of the values recorded as P2. The size of the characters is independent of the scale in Y. When using geodetic coordinates the size of the lettering will not be changed as a function of plot scale. The size will be as specified by P2. If a number is entered for P 1 that does not correspond to an entry in the text file called, no entry will be plotted. The omission will be noted on the screen during plotting. A single entry contains leaders and position of text. A proper entry for 500-599 codes always has an odd number of points.

## Word and character file

Words and symbols are entered into files in the format specified below for retrieval by GSMAP using codes 500-599 and 700-799 (single line entries only). Any valid DOS filename can be used for this file. The file name will be given as the second entry during plotting. In this file, the number is the label for the succeeding words, characters, or numbers which constitute the entry that will be plotted on the diagram. The number at the start of each label entry corresponds to Parameter 1 entered from the keypad during digitizing. The "EOT" is the tag marking the end of the entry and must be placed on the line below the text for the entry (EOT stands for 'end of text'). Commas are used to separate the three parts of the table entry.

Number, "Label",  
"EOT"

The file below is included as DRAW.RU

```
1, "am",  
"EOT"  
2, "&sc",  
"EOT"  
3, "\s",  
"EOT"  
4, "Xgn",  
"EOT"  
5, "Ti",  
"EOT"  
6, "LAST CHANCE"  
"  LODE",  
"EOT"  
11, "MY FAULT",  
"EOT"  
12, "YOUR FAULT",  
"EOT"  
10, "GEOLOGIC MAP OF THE EXERCISE AREA",  
"EOT"
```

An entry such as:

```
27, "UNKNOWN"  
"RESOURCE"  
"POTENTIAL",  
"EOT"
```

will plot as :

```
UNKNOWN  
RESOURCE  
POTENTIAL
```

Text files (ASCII files) can be prepared using any word processing program that does not leave embedded characters, e.g. non document mode WordStar. The file must be formatted like the example above. A suitable file is easily prepared using Option 6 of GSMUTIL.



For multi-line text entries do not put a comma (,) at the end of the lines of text except at the end of the last line. A comma at the end of any previous line of text will be equivalent to a blank line of text. The comma at the end of the line of text before the "EOT" end of text line is optional.

A blank line of text needed for spacing can be entered as a record reading " " (double quote space double quote); although a comma after the previous line has the same effect it's too hard to recognize it as a blank line when reading the file.

Quotation marks (") cannot be used in a label because they are a delimiter in BASIC. A substitute is provided by redefining the } character in Font #0 as shown below and in the extended character sets as ASCII 180 in Font #1 and as ASCII 214 in Font #2.

A maximum of 150 characters (including blanks) can be enclosed between the quotation marks on a single line. There is essentially no limit to the number of lines that can be put into a multi-line entry.

#### SPECIAL CHARACTERS

Five keyboard characters have been "redefined" in Font #0 so that they plot differently than they appear on the keyboard and screen; these are of special use to geologists.

\=Cambrian "C"  
&=Pennsylvanian "P"  
@=Triassic "TR"  
{=Superscript ° (degrees)  
}=Superscript " (seconds)

The redefined keyboard "special" keyboard characters in Font #0 (not the other fonts) as well as the special characters in the extended character set of fonts #1 and #2 are transmitted to HPGL files as well as to the screen and to the plotter. These geologic characters and other characters in the extended set (ASCII 128-255) are available in fonts #0, #1 and #2.

#### ADDITIONS TO TEXT FILES DURING DIGITIZING

Single line additions to an existing text file can be made during digitizing, GSMAP, GSMEDIT. Enter CODE (500-599 or 700-799 in plot control file, P1=0 (therefore undefined), P2=Size of text. Prompts will call for entry of text from the keyboard. Text is stored in the existing text file specified in the plot control file for the specified code, given a number one greater than the highest number already specified in the file.

## SPLINED LINES - CODES 600-699

CODES 600-699 are used for lines and function much like CODES 1-99, but when the lines are plotted they are smoothed by splining. Up to five times as many segments as digitized are plotted for each entry. The computer generates the required points by "curve-fitting" the line according to a cubic equation. The splined line starts at the first point digitized, ends at the last point digitized, and goes through all digitized points.

### Digitizing and plotting

Digitizing and plotting are done in the same ways as for codes 1-99 as described earlier in this section.

All lines are drawn by the plotter as a series of straight line segments. The effect of splining is to smooth the "curve" digitized by a series of short straight lines (on the plotter and on the screen); the data base is not modified. Splining is done for entries made up of 6 to 2500 digitized points. If there are 5 or fewer data points, or 2501 or more, no splining will be done. The maximum effect will be seen on lines with less than 1000 points. The splining algorithm creates a series of equally spaced points along the line, to fit a series of cubic curves calculated to fit each set of four digitized points in sequence down the line. The plotted line passes through these calculated points as well as through all of the data points. For the details of the procedure, see Covington, (1986). If digitized points are not equally spaced, the maximum effect will be seen where points are most widely spaced. In effect, if the digitized points are close together, the line joining them is relatively straight; if points are far apart, more curvature is allowed. A line will be plotted connecting segments of equal length to a set of points  $N$  times the number digitized, where  $N$  is the largest integer determined by dividing 5,000 by the number of points in the line (a number in the range 1 to 5).

Entries digitized as codes 1-99 can be changed to codes 600-699 for plotting using Option 6.

### WARNING:

Although the curve-fitting done during plotting of codes 600-699 can improve the appearance of lines, splining can create strange effects at sharp corners. The right-hand square in Fig. 9 is a worst case. The plotting of splined lines with many points, especially of patterned lines (dotted, dashed) may be slow. If a negative spacing for a decorated line is specified, the splined points used for drawing the line will be decorated with symbols, not the original digitized points. Codes for splined lines are especially appropriate if line type 98 (parallel lines) is to be used when plotting.

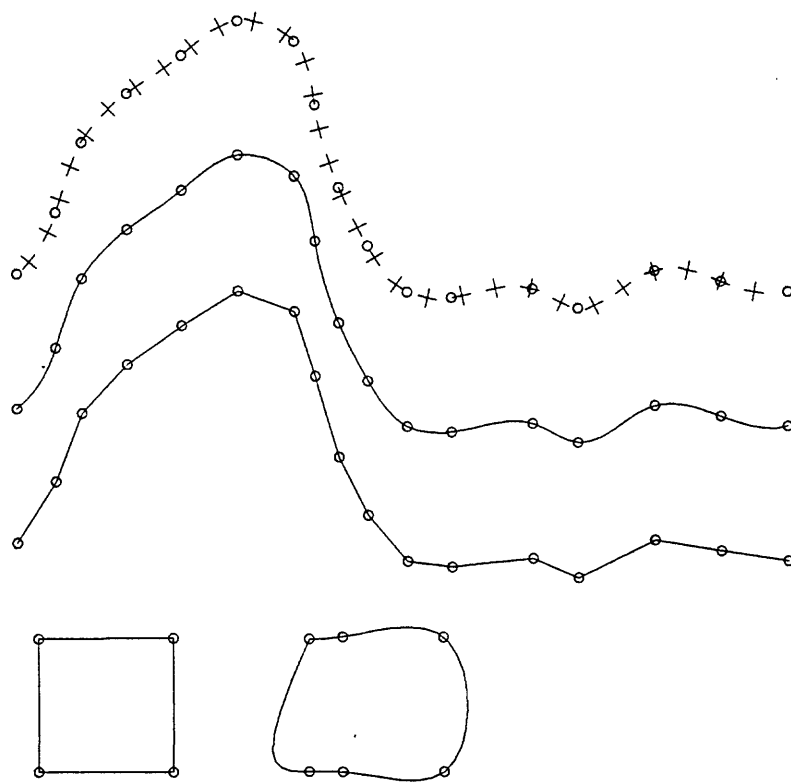


Figure 9. The upper three curves were digitized using 17 points, (circles); the uppermost was plotted using CODE 1, line type 99, symbol 9; the center curve was plotted as a CODE 601, and splined to a smooth curve; the lower curve was plotted as code 1, line type 0, and clearly shows breaks where data points are located. The two polygons were plotted using CODE 601 (digitized points are shown by circles). The upper left corner of each polygon was digitized twice (to close the polygon. As the square on the left is defined by 5 points, no splining took place. The figure on the right was digitized as a square (7 points) and splined to its deformed representation.

## CODES 700-799

### SPECIAL ALPHANUMERIC ENTRIES - WORDS, LETTERS, NUMBERS, AND A FEW SPECIAL CHARACTERS

CODES 700-799 are used for alphanumeric entries that have a single line of text. The letters/numbers to be plotted are entered into an ASCII data file that will be called by its file name during plotting, and plotted according to the manner digitized. The selection of CODES is based on the pen needed for plotting, the slant angle for letters (block letters or italics), and the font to be used in plotting. The angle that the character, word, or line of text is to be entered on the page is established at the time of digitizing. Separate groups of text entries into different codes. 500-599 codes should be used for text if multi-line entries are needed or if leaders are needed, as for rock unit labels on geologic maps. CODES 700-799 codes are more efficient if the angle for plotting the words is to be varied from entry to entry, or if words are to be spaced along a digitized line.

#### Digitizing

Three entries from the digitizer keypad are required:

1. CODE: user defined on the basis of pen, slant of letters, words, fonts, and text spacing desired. Any code 700 through 799 can be used.
2. P1: the number of the entry to be placed on the plot corresponding to the number for the entry in the ASCII data file.
3. P2: the size of the lettering, expressed in units of 1/1000 inch.

The first point digitized, using either the 0 or the 1 key, positions the text line or character. The digitized point locates the lower left corner of the first character of the line of text. Subsequent points establish a line that positions and rotates the text.

If the 1 key is used for the first point, the entry is complete. The text will print to the right of the point.

If the 0 key is used for the first point and the 1 key is used to digitize a second point, these points define a rotation for the entry (the 1 key completes the entry).

If the 0 key is used for the first point and for up to 3 intermediate points, and the 1 key for the last point, these points define a series of line segments. The characters of the text will be evenly spaced along these line segments.

If the 0 key is used for the first point, and for more than 4 intermediate points, and the 1 key for the last point, these points define a line. The characters of the text will be evenly spaced along a splined line through these points.

If proper plot control files and text files have been prepared the screen will display the words and/or characters that will be plotted. If these files have not been prepared, the screen will show the point digitized for a one-point entry, or the line digitized for a multi-point entry.

## Plotting

Plots of codes 700-799 require two sets of entries. During plotting in the interactive mode, prompts will request all entries. Each set is specified on one line of a plot control file.

The first set provides:

CODE, PEN NUMBER, 0 (or slant angle of letters), 0 (or slant angle of words, if digitized with one point).

The first set:

Entry 1: the CODE desired, a number between (700 and 799), followed by a comma (,).

Entry 2: the pen number, followed by a comma (,).

Entry 3: the slant angle for letters (an angle measured clockwise from the vertical): 0 degrees for block lettering, about 30 degrees for simulated italic letters, followed by a comma (,).

Entry 4: the angle of rotation for blocks of text on plot (an angle measured from the horizontal, (+ counterclockwise, - clockwise), followed by a comma. Comments between double quote characters may be added after the final comma, and should be a part of a plot control file.

The second set. Two entries provide:

FILENAME FOR TEXT, FONT #

Entry 1: the name of the file containing the data to be plotted, followed by a comma (,). This entry must contain the complete filename with extension.

Entry 2. the number of the font desired. Font #0 contains special geologic characters.

SANGRE de CRISTO RANGE

SANGRE de CRISTO RANGE

SANGRE de CRISTO RANGE

Figure 10. Examples of text plotted using code 700.

The text rotates around the initial digitized point during plotting if rotated in the plot file and if the entry was digitized using one point. When using Cartesian coordinates the size of the lettering that will be plotted varies with the scale of the plot in X (horizontal); e.g. a half-sized plot, XSCALE=0.5, will have letters half the size of the values recorded as P2. The size of the characters is independent of the scale in Y. When using geodetic coordinates the size of the lettering will not be changed as a function of plot scale. The size will be as specified by P2. If a number is entered for P1 that does not correspond to an entry in the text file called, no entry will be plotted. The omission will be noted on the screen during plotting.

## SETUPDB

Operation of GSMAP requires that ASCII plot control, projection parameter, and text files be prepared before starting the program. Most users copy and modify existing files or create these files using a text editing program. This modus operandi suits most users, but others may find this utility useful. Add the program file SETUPDB.EXE to your active area and the file SETUPDB.TAB to the area specified by the environmental variable GSFILES.

SETUPDB is a utility program that can be used to create files GSMAP needs from scratch. The user must respond to a series of prompts; these require an understanding of GSMAP, and, most important, a plan for the illustration, codes to be used, pens, scale, and other plot parameters. A planning sheet such as the one on the next page will be useful (if you fill it out).

With planning sheet in front of you, documentation for GSMAP readily available (the wall chart may be enough), and, if the data base is to use geodetic coordinates, information readily found on the base map (add a copy to the pile you've assembled), you're ready to work. The REFERENCE section of the documentation and discussion of MAP PROJECTIONS will be particularly useful. The zone number provided in the table below will be needed when building projection parameter files for 7 1/2 minute quadrangles.

| Zone # | Zone             | Zone # | Zone                   | Zone # | Zone                 |
|--------|------------------|--------|------------------------|--------|----------------------|
| -----  |                  |        |                        |        |                      |
| 101    | ALABAMA EAST     | 1703   | LOUISIANA OFFSHORE     | 3601   | OREGON NORTH         |
| 102    | ALABAMA WEST     | 1801   | MAINE EAST             | 3602   | OREGON SOUTH         |
| 201    | ARIZONA EAST     | 1802   | MAINE WEST             | 3701   | PENNSYLVANIA NORTH   |
| 202    | ARIZONA CENTRAL  | 1900   | MARYLAND               | 3702   | PENNSYLVANIA SOUTH   |
| 203    | ARIZONA WEST     | 2001   | MASSACHUSETTS MAINLAND | 3800   | RHODE ISLAND         |
| 301    | ARKANSAS NORTH   | 2002   | MASSACHUSETTS ISLAND   | 3901   | SOUTH CAROLINA NORTH |
| 302    | ARKANSAS SOUTH   | 2101   | MICHIGAN EAST          | 4001   | SOUTH DAKOTA NORTH   |
| 401    | CALIFORNIA I     | 2102   | MICHIGAN CENTRAL/M     | 4002   | SOUTH DAKOTA SOUTH   |
| 402    | CALIFORNIA II    | 2103   | MICHIGAN WEST          | 4100   | TENNESSEE            |
| 403    | CALIFORNIA III   | 2111   | MICHIGAN NORTH         | 4201   | TEXAS NORTH          |
| 404    | CALIFORNIA IV    | 2112   | MICHIGAN CENTRAL/L     | 4202   | TEXAS NORTH CENTRAL  |
| 405    | CALIFORNIA V     | 2113   | MICHIGAN SOUTH         | 4203   | TEXAS CENTRAL        |
| 406    | CALIFORNIA VI    | 2201   | MINNESOTA NORTH        | 4204   | TEXAS SOUTH CENTRAL  |
| 407    | CALIFORNIA VII   | 2202   | MINNESOTA CENTRAL      | 4205   | TEXAS SOUTH          |
| 501    | COLORADO NORTH   | 2203   | MINNESOTA SOUTH        | 4301   | UTAH NORTH           |
| 502    | COLORADO CENTRAL | 2301   | MISSISSIPPI EAST       | 4302   | UTAH CENTRAL         |
| 503    | COLORADO SOUTH   | 2302   | MISSISSIPPI WEST       | 4303   | UTAH SOUTH           |
| 600    | CONNECTICUT      | 2401   | MISSOURI EAST          | 4400   | VERMONT              |
| 700    | DELAWARE         | 2402   | MISSOURI CENTRAL       | 4501   | VIRGINIA NORTH       |
| 901    | FLORIDA EAST     | 2403   | MISSOURI WEST          | 4502   | VIRGINIA SOUTH       |
| 902    | FLORIDA WEST     | 2501   | MONTANA NORTH          | 4601   | WASHINGTON NORTH     |
| 903    | FLORIDA NORTH    | 2502   | MONTANA CENTRAL        | 4602   | WASHINGTON SOUTH     |
| 1001   | GEORGIA EAST     | 2503   | MONTANA SOUTH          | 4701   | WEST VIRGINIA NORTH  |
| 1002   | GEORGIA WEST     | 2601   | NEBRASKA NORTH         | 4702   | WEST VIRGINIA SOUTH  |
| 5101   | HAWAII 1         | 2602   | NEBRASKA SOUTH         | 4801   | WISCONSIN NORTH      |
| 5102   | HAWAII 2         | 2701   | NEVADA EAST            | 4802   | WISCONSIN CENTRAL    |
| 5103   | HAWAII 3         | 2702   | NEVADA CENTRAL         | 4803   | WISCONSIN SOUTH      |
| 5104   | HAWAII 4         | 2703   | NEVADA WEST            | 4901   | WYOMING EAST         |
| 5105   | HAWAII 5         | 2800   | NEW HAMPSHIRE          | 4902   | WYOMING EAST CENTRAL |
| 1101   | IDAHO EAST       | 2900   | NEW JERSEY             | 4903   | WYOMING WEST CENTRAL |
| 1102   | IDAHO CENTRAL    | 3001   | NEW MEXICO EAST        | 4904   | WYOMING WEST         |
| 1103   | IDAHO WEST       | 3002   | NEW MEXICO CENTRAL     | 5001   | ALASKA ZONE NO. 1    |
| 1201   | ILLINOIS EAST    | 3003   | NEW MEXICO WEST        | 5002   | ALASKA ZONE NO. 2    |
| 1202   | ILLINOIS WEST    | 3101   | NEW YORK EAST          | 5003   | ALASKA ZONE NO. 3    |
| 1301   | INDIANA EAST     | 3102   | NEW YORK CENTRAL       | 5004   | ALASKA ZONE NO. 4    |
| 1302   | INDIANA WEST     | 3103   | NEW YORK WEST          | 5005   | ALASKA ZONE NO. 5    |
| 1401   | IOWA NORTH       | 3104   | NEW YORK LONG ISLAND   | 5006   | ALASKA ZONE NO. 6    |
| 1402   | IOWA SOUTH       | 3200   | NORTH CAROLINA         | 5007   | ALASKA ZONE NO. 7    |
| 1501   | KANSAS NORTH     | 3301   | NORTH DAKOTA NORTH     | 5008   | ALASKA ZONE NO. 8    |
| 1502   | KANSAS SOUTH     | 3302   | NORTH DAKOTA SOUTH     | 5009   | ALASKA ZONE NO. 9    |
| 1601   | KENTUCKY NORTH   | 3401   | OHIO NORTH             | 5301   | PUERTO RICO          |
| 1602   | KENTUCKY SOUTH   | 3402   | OHIO SOUTH             | 5302   | SAMOA                |
| 1701   | LOUISIANA NORTH  | 3501   | OKLAHOMA NORTH         | 5201   | VIRGIN ISLANDS       |
| 1702   | LOUISIANA SOUTH  | 3502   | OKLAHOMA SOUTH         | 5202   | ST. CROIX            |

## GSMAP PLANNING SHEET

DATA BASE NAME/CORNERS

# PLOT CONTROL FILE

PROJECTION FILE

[illegible]

## OPERATION OF SETUPDB

Start SETUPDB by entering **SETUPDB** from the DOS prompt.

Prompts will take you through the process of creating a data base, a plot control file, projection parameter file, and opening a text file for later use. The name of the data base will be used for the name of all files created by the program; the two data base files will have extensions LSF and NDX, the plot control file will have the extension PLT, the projection file the extension .PRJ. The text files will bear the names and extensions that you choose for 500-599 and 700-799 codes. If you are creating a geodetic data base for a 7 1/2 minute quadrangle you will need the number of the State Plane Zone from the table printed with this documentation. The State Plane zone will be specified by name (not by number) on the base map. Prompts will resemble those of GSMAP and will not be discussed in detail here. Each must be answered in turn.

ENTER DATA BASE NAME:?

IS THIS A GEODETIC OR CARTESIAN DATA BASE?(G/C):

ENTER TITLE:

### GEODETIC DATA BASES

The prompt below will be displayed if the data base is a geodetic data base.

#### TYPES OF MAPS

- 1 - 7 1/2 MINUTE
- 2 - 15 MINUTE
- 3 - 30 MIN LAT x 1 DEG LONG
- 4 - 1 DEG LAT x 2 DEG LONG
- 5 - OTHER

ENTER TYPE:

If type 1, 2, 3 or 4 is selected the following prompt will be seen:

ENTER LAT/LON OF NORTHWEST CORNER:

DD,MM,SS,C,DDD,MM,SS,C:

Similar prompts for all corners will be seen if 5 is selected.

### CARTESIAN DATA BASES

The prompt below will be seen if the data base is a Cartesian data base.

#### OPTIONAL METHODS FOR SPECIFYING DATA BASE CORNERS FROM KEYBOARD

- 1 - SPECIFY UPPER RIGHT CORNER (X,Y)
- 2 - SPECIFY LOWER LEFT (X,Y), UPPER RIGHT(X,Y)
- 3 - ALL FOUR CORNERS

ENTER OPTION:

If option 1 is chosen the prompt will be as below; similar prompts will be displayed for as many corners as required by the option selected:

ENTER UPPER RIGHT CORNER (X,Y):

### GEODETIC DATA BASES

Projection parameter files will be created for standard map series without many prompts. The equatorial and polar radii of Clarke 1866 will be used. If method 1 was selected for a geodetic data base covering a 7 1/2 minute quadrangle, a prompt similar to the print below will be displayed:

ENTER STATE PLANE ZONE NUMBER FROM TABLE IN DOCUMENTATION: e.g. 501

A message similar to the print below will be displayed on the screen:



ZONE 501 IS COLORADO NORTH  
 PROJECTION = LAMBERT CONFORMAL CONIC  
 EQUATORIAL RADIUS (KMS) = 6378.2064  
 POLAR RADIUS (KMS) = 6356.5838  
 CENTRAL MERIDIAN = 105 30 0 W  
 SCALE FACTOR = 1  
 FIRST STANDARD PARALLEL = 40 47 3.814697E-06 N  
 SECOND STANDARD PARALLEL = 39 43 0 N  
 BASE LATITUDE = 39 20 0 N  
 FALSE EASTING(KMS) = 609.6012192024384  
 FALSE NORTHING(KMS) = 0  
 ARE THESE PARAMETERS CORRECT? (Y/N):

Lambert conformal conic or transverse Mercator projections will be selected to match those of the State Plane Zone (Snyder, 1987, p. 52-56). The parameters displayed provide information used in the Projection parameter file, e.g. the projection parameter file created from the from the example above:

|                |
|----------------|
| 3              |
| 6378.2064      |
| 6356.5838      |
| 40 47 0.000 N  |
| 39 43 0.000 N  |
| 105 30 0.000 W |

The polyconic projection with meridian central to the map will be selected for 15 minute quadrangles, method 2 above.

The Universal Transverse Mercator projection with correct zone will be selected for 30 by 60 minute quadrangles, method 3 above.

The Transverse Mercator projection with principal meridian central to the map will be selected for 1 by 2 degree quadrangles, method 4 above.

### GEODETIC AND CARTESIAN DATA BASES

The next prompts selecting scale will be displayed as required: For geodetic data bases from 7 1/2 minute quadrangles a default scale of 1:24,000 will be selected, for 30 by 60 minute quadrangles, 1:100,000, and for 1 by 2 degree quadrangles, a scale of 1:250,000. The scales for other plot control files must be entered by the user.

ENTER XSCALE,YSCALE:

ENTER XOFF,YOFF:

DRAFT MODE?(y/N): The default is N

ROTATE PLOT?(y/N): The default is N

ENTER SPEED,FORCE:

Opportunity is next afforded for creating a grid of lines in the new data base. One important use is easy creation of border lines precisely bounding a quadrangle.

DO YOU WANT A GRID OF LINES: If Y

ENTER CODE FOR OUTPUT SEGMENTS e.g. 98

Geodetic format is shown for the two prompts below

ENTER DELTA LATITUDE (DD,MM,SS): e.g 0,2,30

ENTER DELTA LONGITUDE (DDD,MM,SS): e.g 0,2,30

The remaining prompts get down to the business of selecting codes to be entered into the plot control file. Details of responses depend on the codes specified. Prompts are printed below.

FOR LINES CODES 1-99, 600-699

ENTER CODE(0 TO EXIT): ?  
ENTER COMMENT:  
ENTER PEN NO: ?  
ENTER LINE TYPE(0-17)  
ENTER DECORATING SYMBOL: ?

FOR SYMBOLS AND POSTINGS FROM A DATA FILE CODES 100-199

ENTER CODE(0 TO EXIT): ?  
ENTER COMMENT:  
ENTER PEN NO: ?  
ENTER SYMBOL NUMBER: ?  
ENTER SYMBOL SIZE:  
ENTER DATA FILE NAME: ?  
ENTER FONT ?  
ENTER # OF DATA COLUMNS: ?  
ENTER # OF DATA COLUMN TO BE PLOTTED: ?  
ENTER CHARACTER WIDTH: ?  
ENTER CHARACTER HEIGHT:?

FOR SYMBOLS CODES 200-299

ENTER CODE(0 TO EXIT): ?  
ENTER COMMENT:  
ENTER PEN NO: ?

FOR SYMBOLS CODES 300-399

ENTER CODE(0 TO EXIT): ?  
ENTER COMMENT:  
ENTER PEN NO: ?  
ENTER ROTATION ANGLE FOR SYMBOL  
RANDOMIZE ANGLE(Y/N): ?

FOR POLYGONS CODES 400-499, 800-899

For fill type 0

ENTER CODE(0 TO EXIT): ?  
ENTER COMMENT:  
ENTER PEN NO FOR OUTLINE: ?  
ENTER LINE TYPE FOR OUTLINE (0-17): ?  
ENTER FILL TYPE: ?

For fill types 1, 2, 4, 5

ENTER SPACING BETWEEN LINES  
ENTER ANGLE FOR FILL: ?  
ENTER PEN NUMBER FOR FILL: ?

For fill types 3, 6

ENTER CODE(0 TO EXIT): ?  
ENTER COMMENT:  
ENTER PEN NO FOR OUTLINE: ?  
ENTER LINE TYPE FOR OUTLINE (0-17): ?  
ENTER FILL TYPE: ?  
ENTER X SPACING BETWEEN SYMBOLS: ?  
ENTER Y SPACING BETWEEN SYMBOLS: ?  
ENTER PEN NUMBER FOR FILL: ?  
ENTER SYMBOL NUMBER: ?  
ENTER SYMBOL SIZE: ?  
RANDOMIZE ANGLE(Y/N): ?

FOR TEXT CODES 500-599, 700-799

ENTER CODE(0 TO EXIT): ?  
ENTER COMMENT:  
ENTER PEN NO: ?  
ENTER SLANT ANGLE OF LETTERS: ?  
ENTER SLANT ANGLE OF WORDS: ?  
ENTER TEXT FILE NAME: ?  
ENTER FONT ?

Entry of CODE=0 ends operation of SETUPDB.

## Files created by SETUPDB

The name of a data base is selected by the user, then used with different extensions for data base, plot control, and projection files for geodetic data bases. The list below assumes a name of DATABASE:

DATABASE.LSF Data base file, data records

DATABASE.NDX Data base file, index to data records

DATABASE.NOD Data base file, node records

A grid or set of boundary lines can be created

DATABASE.PLT Plot control file

DATABASE.PRJ Projection parameter file for geodetic data base

Text files for 500-599 and 700-799 codes will be opened with names selected during the process of creating the plot control file. Entries can be made using an ASCII text processing program. Single line entries can be made from the keyboard during the process of digitizing by entering a P1 value of 0 as described in the documentation for GSMAP and GSMEDIT.

Data files for 100-199 codes must be created outside of SETUPDB, GSMAP, and GSMEDIT.

The data base files are ready for digitizing using GSMAP or GSMEDIT.

Modifications and additions to the ASCII files can be made using an ASCII text processing program.

## CHAPTER 2

### UTILITY PROGRAMS FOR USE WITH GSMAP DATA BASES

This section describes programs that are useful when working with data bases created using GSMAP Versions 3-9 (and GSDRAW versions 3-6). Familiarity with GSMAP practice is assumed in this description. These programs combine functions of programs released earlier and add additional capabilities.

GSMUTIL Version 9.0 has 17 options that can be used to process GSMAP data bases in either geodetic or Cartesian coordinates. A digitizer and plotter and configuration files are not required for operation.

#### Options:

1. To create a new data base containing entries selected by code from an existing data base, or to select the entire contents of a data base with deleted entries removed.
2. To create an ASCII file from an existing data base. The file can contain specified entries selected by code or the entire contents of the data base.
3. To select entries from an existing data base inside one or more digitized polygons in another data base.
4. To create a data base from a formatted ASCII file.
5. Select entries inside or outside one polygon defined by points in an ASCII file from an existing data base.
6. To write a formatted ASCII file for use with 500-599 codes. Sequential numbering and proper punctuation are automatically provided.
7. To merge two or more data bases to form a new output data base containing combined entries.
8. To compute the lengths of lines and the areas and perimeters of polygons.
9. To filter the contents of a data base and create an output data base.
10. To read an input data base, snap node points (ends of lines) together and create an output data base.
11. To convert a geodetic data base to a Cartesian data base.
12. To convert a Cartesian data base to a geodetic data base.
13. To generate a Cartesian or geodetic data base containing a grid of lines at spacings chosen by the user.
14. To prepare a listing of codes used in an existing GSMAP data base.
15. To read a GSPOST data base and create an output GSMAP data base.
16. To read lines from an input GSMAP data base and generate an output GSMAP data base containing paired lines, one on each side of the input lines at a user-specified distance.
17. To read lines from an input GSMAP data base and generate splined lines in an output GSMAP data base.

GSMEDIT is a screen edit program permitting editing of data bases using either geodetic or Cartesian coordinates using the keyboard of the computer. Points or entries can be deleted, points moved, CODE, P1, and P2 changed; lines broken into segments; the sequence of points in a line reversed, and on-screen digitizing accomplished. GSMEDIT Version 9.0 requires CONFIG9.SCR, CONFIG9.SYM, data base files, font files, projection parameter files, and a plot control file. A digitizer and plotter are not used.

GSMPBLD Version 9.0 automatically assembles polygons from lines (entries code group 1-99 in an existing data base, then attributes the polygons using label points in a second data base, and writes these polygons in an output data base. There are special requirements for the input data bases.

GSMPBS Version 9.0 uses the screen display to select specific lines (entries code groups 1-99, 400-499, 600-699) from an existing data base and assembles these lines into closed polygons or into lines in an output data base. CONFIG9.SYM, CONFIG9.SCR and font files are required. A digitizer and plotter are not utilized.

## GSMUTIL

The program file GSMUTIL.EXE must be in the default area or the current path. No configuration files are required. GSMUTIL Version 9.0 can be used with data bases that use either geodetic or Cartesian coordinates.

Trimming a data base (option 3) requires that two data bases be available before entering GSMUTIL.

1, the input data base to be trimmed.

2, the trim data base that contains one or more closed polygons that serve as trim borders as its only entries. The corners of the two data bases must have the same coordinates.

Trimming an input data base using a trim border defined in an ASCII file (option 5) requires that the ASCII file containing the trim border be available before starting GSMUTIL; only one trim border polygon can be used for each pass.

Filtering a data base with geodetic coordinates requires that the correct projection parameter file be available before starting GSMUTIL.

GSMUTIL is started by entering **GSMUTIL**

The screen will briefly display a disclaimer message, then shift to the menu providing choices to the user.

## G S M U T I L

- 1 - SELECT A SUBSET BY CODE INTO OUTPUT DATA BASE
- 2 - CONVERT SELECTED CODES INTO AN ASCII FILE
- 3 - TRIM ON POLYGONAL BORDER DEFINED IN A DATA BASE
- 4 - READ AN ASCII FILE AND CREATE OUTPUT DATA BASE
- 5 - TRIM ON POLYGONAL BORDER DEFINED IN AN ASCII FILE
- 6 - FORMAT A TEXT FILE FOR 500/700 CODES
- 7 - MERGE MULTIPLE INPUT DATA SETS INTO ONE OUTPUT DATA SET
- 8 - COMPUTE LENGTHS OF LINES OR AREAS AND PERIMETERS OF POLYGONS
- 9 - FILTER AN INPUT DATA BASE INTO AN OUTPUT DATA BASE
- 10 - READ INPUT DATA BASE, SNAP NODES AND CREATE AN OUTPUT DATA BASE
- 11 - CONVERT A GEODETIC DATA BASE TO A CARTESIAN DATA BASE
- 12 - CONVERT A CARTESIAN DATA BASE TO A GEODETIC DATA BASE
- 13 - GENERATE AN OUTPUT DATA BASE CONTAINING A GRID OF LINES
- 14 - PREPARE TABLE OF CODES THAT OCCUR IN A DATA BASE
- 15 - READ A GSPPOST FILE AND CREATE AN OUTPUT DATA BASE
- 16 - GENERATE DOUBLE LINES FROM SINGLE TRACE FOR SPEC. CODES
- 17 - GENERATE SPLINED LINES FROM LINES OF SPEC.CODES
- 18 - EXIT

ENTER CHOICE BY NUMBER:

## Option 1 - SELECT A SUBSET BY CODE INTO OUTPUT DATA BASE

This option permits the user to select an input GSMAP data base, create an output (new) data base using the same coordinate system with the same corners, and copy entries selected by code from the input data base into the output data base. This enables:

1. Reorganization of the output data base so that all entries of the same kind are sequential (minimizing font and pen swapping), and at the same time removing deleted entries.
2. Reducing the size of the data base by removing deleted entries (select all codes by specifying -1 for all. This is quick, but does not optimize the data base for plotting).

Enter 1 in response to the prompt on the Main Menu, then answer each prompt in turn. Prompts:

ENTER INPUT DATA BASE NAME:

ENTER OUTPUT DATA BASE NAME:

ENTER CODE TO BE SELECTED(-1=ALL,0=EXIT):

After desired codes have been selected, entry of 0 will return operations to the Main Menu.

## Option 2 - CONVERT SELECTED CODES INTO AN ASCII FILE

This option permits the user to select an input GSMAP data base and convert the data base into an ASCII file. This ASCII file can be edited using a text editor, and provides for easy export of GSMAP data to other graphic systems. Enter 2 in response to the prompt on the Main Menu, then answer each prompt in turn. Prompts:

ENTER INPUT DATA BASE NAME:

ENTER FILENAME FOR ASCII OUTPUT FILE:

ENTER CODE TO BE SELECTED(-1=ALL,0=EXIT):

After entries of all desired codes have been selected, entry of 0 at the ENTER CODE TO BE SELECTED(-1=ALL,0=EXIT): prompt will return operations to the Main Menu.

### ASCII FILE FROM CARTESIAN DATA BASE

The following example is part of an ASCII file created using option 2 GSMUTIL from a Cartesian data base and shows the format required by option 4.

Each record in the file ends with a carriage return. The first line of the file contains the word CARTESIAN

The second line of the file contains the title of the data base (not the name). The first 8 characters in this line of the as the title for the database.

The next 4 lines contain the coordinates of the data base corners (X and Y separated by a blank).

The remainder of the file contains data for entries. The first line for each entry contains the Entry number, number of points in the entry, CODE, P1 and P2 separated by blank spaces. Subsequent lines contain X and Y coordinates for points in the entry separated by blank spaces.

Comments (not a part of the file)

|           |     |          |   |          |  |                                           |  |
|-----------|-----|----------|---|----------|--|-------------------------------------------|--|
| CARTESIAN |     |          |   |          |  | Specifies Cartesian coordinates           |  |
| EXERCISE  |     |          |   |          |  | Title                                     |  |
| 0.000000  |     | 4.360000 |   |          |  | X,Y Coordinates UL corner of data base    |  |
| 0.000000  |     | 0.000000 |   |          |  | X,Y Coordinates LL corner of data base    |  |
| 6.913000  |     | 0.005000 |   |          |  | X,Y Coordinates LR corner of data base    |  |
| 6.878000  |     | 4.388000 |   |          |  | X,Y Coordinates UR corner of data base    |  |
| 8         | 10  | 1        | 0 | 0        |  | Entry #, #Points=10, Code=1 P1=0, P2=0    |  |
|           |     | 0.601000 |   | 1.547000 |  | X,Y coordinate first point of entry       |  |
|           |     | 0.627000 |   | 1.512000 |  | X,Y coordinate next point                 |  |
|           |     | 0.636000 |   | 1.489000 |  |                                           |  |
|           |     | 0.653000 |   | 1.461000 |  |                                           |  |
|           |     | 0.677000 |   | 1.430000 |  |                                           |  |
|           |     | 0.700000 |   | 1.408000 |  |                                           |  |
|           |     | 0.731000 |   | 1.382000 |  |                                           |  |
|           |     | 0.755000 |   | 1.363000 |  |                                           |  |
|           |     | 0.782000 |   | 1.343000 |  |                                           |  |
|           |     | 0.809000 |   | 1.324000 |  |                                           |  |
| 9         | 130 | 1        | 0 | 0        |  | Entry #=9, #Points=130, Code=1 P1=0, P2=0 |  |
|           |     | 0.600000 |   | 2.416000 |  | .....                                     |  |
|           |     |          |   |          |  | and more                                  |  |



# ASCII FILE FROM GEODETIC DATA BASE

The following example is part of a geodetic ASCII file created using option 2 GSMUTIL from a geodetic data base and illustrates the format required by option 4.

The first line of the file contains the word GEODETIC.

The second line of the file contains the title of the data base (not the name). The first 16 characters in this line of the ASCII file will be used as the title for the data base.

The next 4 lines contain the coordinates of the four data base corners (Latitude, Longitude, separated by a blank). The sequence is as in GSMAP entry: NW,SW,SE,NE. Latitude and longitude are specified in decimal degrees. N latitudes are positive, S latitudes negative, W longitudes are negative, E longitudes positive.

The remainder of the file contains data for entries. For each entry, the first line for the entry contains the Entry number, number of points in the entry, CODE, P1, and P2, separated by blank spaces. Subsequent lines contain the latitude and longitude coordinates of data points, (latitude and longitude separated by a blank. Latitude and longitude are specified in decimal degrees. N latitudes are positive, S latitudes negative, W longitudes are negative, E longitudes positive.

|                                                                                                                                  |   |     |           |             |                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------------------------------|---|-----|-----------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>GEODETIC<br/>SAMPLE<br/>50.000000 -125.000000<br/>30.000000 -115.000000<br/>25.000000 -75.000000<br/>45.000000 -65.000000</p> |   |     |           |             | <p>(Comments are not a part of the file)<br/>Designates a geodetic data base<br/>TITLE of the data base<br/>Lat/Lon NW corner<br/>Lat/Lon SW corner<br/>Lat/Lon SE corner<br/>Lat/Lon NE corner</p> |
| 1                                                                                                                                | 5 | 1   | 0         | 0           | Entry# #points CODE P1 P2                                                                                                                                                                           |
|                                                                                                                                  |   |     | 40.674453 | -119.800559 | Lat/Lon of digitized point                                                                                                                                                                          |
|                                                                                                                                  |   |     | 40.705072 | -119.776908 | "                                                                                                                                                                                                   |
|                                                                                                                                  |   |     | 40.727699 | -119.757452 | "                                                                                                                                                                                                   |
|                                                                                                                                  |   |     | 40.729308 | -119.732134 | "                                                                                                                                                                                                   |
|                                                                                                                                  |   |     | 40.723412 | -119.707951 | "                                                                                                                                                                                                   |
| 2                                                                                                                                | 3 | 1   | 0         | 0           | Entry# #points CODE P1 P2                                                                                                                                                                           |
|                                                                                                                                  |   |     | 40.284576 | -118.906325 | Latitude, Longitude, first point                                                                                                                                                                    |
|                                                                                                                                  |   |     | 40.318361 | -118.908715 | Latitude, Longitude, second point                                                                                                                                                                   |
|                                                                                                                                  |   |     | 33.994469 | -118.157566 | Latitude, Longitude, third point                                                                                                                                                                    |
| 3                                                                                                                                | 1 | 201 | 0         | 45          | Entry#=3 #points=1, CODE=201, P1=0, P2=45                                                                                                                                                           |
|                                                                                                                                  |   |     | 32.979038 | -116.430075 | Latitude, Longitude of point                                                                                                                                                                        |

ASCII files created using Option 2 can be modified using standard text editing programs. If this is done be careful to see that each record in the file ends with a carriage return, and no blank lines are created by the edit program. Admonition !! Although editing the ASCII file is perhaps the most powerful method of editing a file, the uninitiated will find no easier way to corrupt a file. Work with backups, check and check again, and remember that some word processing programs add printing characters that are unacceptable for editing of these ASCII files. Be careful to check that the number of points specified in the first line for an entry matches the number of lines=points in the file for that entry.

### Option 3 - TRIM ON POLYGONAL BORDER DEFINED BY A GSMAP DATA BASE

This option permits the user to select an existing (input) GMAP data base and copy the part of the data base inside one or more closed digitized polygons into a new (output) data base. Enter 3 in response to the prompt on the Main Menu, then answer each prompt in turn. Codes in the 400-499 group (polygons) will not be trimmed. If you wish to trim polygons, change the 400-499 codes to those for lines (perhaps those in the 1-99 group). Then trim, and change these codes back to polygon codes in the output data base. Be aware that if you do this and convert these codes back to polygons, those polygons intersected by the trim border probably cannot be successfully filled (patterned). The trimming algorithm trims but does not close. The data base containing the trim polygon(s) must contain these polygons and only these polygons (no deleted entries). One or more digitized points on lines must be inside a trim polygon, or the trimmed entry will not be copied into the output data base. The trim border(s) will not be present in the output (trimmed) data base. Deleted entries will not be copied into the output data base even if they are inside the trim border. The output data base will have the same corners as the input data base. Each trim polygon is limited to 1500 points. There is no limit to the number of trim polygons.

Prompts:

ENTER INPUT DATA BASE NAME:

ENTER OUTPUT DATA BASE NAME:

ENTER NAME OF DATA BASE CONTAINING BORDER:

During operation the bottom line of the screen will display:

INPUT ENTRY = # NEW ENTRY = #

This message provides assurance that the program is running. After completion of the output (trimmed) data base the system will return to the Main Menu.

### Option 4 - READ AN ASCII FILE AND CREATE OUTPUT DATA BASE

This choice permits the user to specify the name of a properly formatted ASCII file and create a GMAP data base. An example to show the format of this file is provided on p.59. Enter 4 in response to the prompt on the Main Menu, then answer each prompt in turn.

ENTER FILENAME FOR INPUT ASCII FILE:

ENTER OUTPUT DATA BASE NAME:

After entry of the name for the output data base the program will run. When operations are complete the system will return to the Main Menu. The input ASCII file must end with a carriage return (no blank lines are permitted at the start or the end of the file). If a blank line is present at the end of the file the program may operate correctly even though it provides an error message "INPUT PAST END ...".

### Option 5 - TRIM ON POLYGONAL BORDER DEFINED IN AN ASCII FILE

This option is similar in function to Option 3 but uses points (up to 5,000) in an ASCII file (the Border Polygon file) to define a single closed polygon used as the trim border. It selects the points in an existing data base that fall either inside or outside this polygon, as specified. The corners of the output data base can either be the corners of the input data base or the maximum and minimum coordinates of the border polygon file. This ASCII file must be created before starting GSMUTIL. Enter 5 in response to the prompt on the Main Menu, then answer each prompt in turn.

## BORDER POLYGON FILE

The border polygon file consists of a series of records providing the latitude and longitude of points that define a closed polygon in the following format: DD,MM,SS,C,DDD,MM,S,C. The first and last points of a closed polygon must be identical. Each line must end with a hard carriage return or you risk an INPUT PAST END error message. The border polygon must not have more than 5,000 points. The ASCII border polygon file must end with a carriage return (no blank lines are permitted anywhere in the file). If a blank line is present at the end of the file the program may operate correctly even though it provides an error message "INPUT PAST END ...".

Example, border file, geodetic coordinates:

DMS Format

|                    |
|--------------------|
| 39,0,0,N,106,0,0,W |
| 38,0,0,N,106,0,0,W |
| 38,0,0,N,104,0,0,W |
| 39,0,0,N,104,0,0,W |
| 39,0,0,N,106,0,0,W |

DD format

|         |
|---------|
| 39,-106 |
| 38,-106 |
| 38,-104 |
| 39,-104 |
| 39,-106 |

Prompts:

ENTER FILENAME OF BORDER POLYGON POINTS:

Enter the name of the file containing the border polygon:

ENTER INPUT DATA BASE NAME:

Enter the name of the input data base. The next prompt will be:

ARE THE COORDINATES GEODETIC OR CARTESIAN?(G/C):

Enter G or C, if geodetic, the next prompt will ask for selection of format:

DECIMAL DEGREES OR DEGREES,MINUTES,SECONDS,C(dd/DMS

Specify the format by entering DD or DMS, the default is degrees, minutes, seconds, compass direction (DMS). The next prompt allows selecting data base corners other than those of the data base being trimmed: DO YOU WANT THE MIN AND MAX OF THE POLYGON AS THE OUTPUT DATA BASE CORNERS (Y/N):

If Y is entered the maximum and minimum coordinates specified in the polygon file (latitudes and longitudes for geodetic coordinates, units for Cartesian coordinates) of the border polygon are used as the corner points for the GSMAP data base; if N is entered, the corners of the input data base will be used as the output data base corners. The next prompt is:

ENTER OUTPUT DATA BASE NAME:

Enter the name chosen for the output data base. The next prompt asks:

DO YOU WANT ENTRIES INSIDE OR OUTSIDE BOUNDARY POLYGON IN DATA BASE?(I/O):

Answer as desired. I copies entries inside the boundary polygon into the output data base, O copies entries that are outside the polygon into the output data base.

Entries codes 400-499 are NOT copied into the new data base. The potentially detrimental effects of cutting polygons into pieces outweigh possible gain. Entries of all other codes will be copied. If you want to trim polygons, change the code(s) to one for lines, trim, then plot as lines to see if polygons have been damaged.

## Option 6 - FORMAT A TEXT FILE FOR THE 500-700 CODES

This option permits writing of a formatted ASCII file to provide text for use with 500-599 and 700-799 codes. It automatically provides sequential numbers for the text entries and proper punctuation. Enter 6 in response to the prompt on the Main Menu, then answer each prompt in turn. Prompts:

DO YOU WANT TO APPEND DATA TO AN EXISTING FILE?(Y/N): Enter Y or N.

ENTER FILENAME: Enter the name of the file to be used as the text file, e.g. MAP.RU.

The next prompt selects between single or multiple-line entries:

ENTER OPTION (1=SINGLE LINE,2= MULTIPLE LINE,3= FINISHED):

Entry of 1 from the ENTER OPTION prompt brings the following prompt:  
ENTER TEXT FOLLOWED BY CARRIAGE RETURN:

Entry of 2 from the ENTER OPTION prompt brings the following prompt:

ENTER EACH LINE FOLLOWED BY A CARRIAGE RETURN:  
TO GENERATE A BLANK LINE ENTER A SPACE (BLANK) CARRIAGE RETURN:  
CARRIAGE RETURN ONLY ON A LINE INDICATES END OF ENTRY:

Characters in the extended character set (ASCII 128-254) can be entered into a text file. Hold the Alt key down, type the number of the character wanted from left to right using the numeric keypad, then release the Alt key. The character shown on the screen will be the character defined by DOS, not the character that will be plotted by GSMAP. You will see the plotted character on the screen using GSMAP and GSMEDIT.

Entry of 3 from the option prompt returns the system to the main Menu.

The ASCII text file produced using Option 6 can be used with codes 500-599 and 700-799. An example that is designed for Font #0 is printed below.

```
1,"am",  
"EOT",  
2,"&sc",  
"EOT",  
3,"\\s"  
"EOT",  
4,"Xgn",  
"EOT",  
5,"Ti",  
"EOT",  
6,"LAST CHANCE"  
"  LODE",  
"EOT",  
10,"GEOLOGIC MAP OF THE EXERCISE AREA",  
"EOT",  
11,"MY FAULT",  
"EOT",  
12,"YOUR FAULT",  
"EOT"
```

## Option 7 - MERGE MULTIPLE DATA BASES INTO AN OUTPUT DATA BASE

This option merges two or more data bases into an output data base. Enter 7 in response to the prompt on the Main Menu, then answer each prompt in turn. Prompts:

WILL THE OUTPUT DATA BASE HAVE GEODETIC OR CARTESIAN COORDINATES (G/C):

ENTER OUTPUT DATA BASE NAME:

ENTER TITLE OF MAP:

GET CORNERS FROM AN EXISTING DATA BASE?(Y/N): Answer y or N.

Geodetic prompts

If Y the prompt will be:

ENTER DATA BASE NAME: Enter the name of the data base that will supply the desired corners:

If N the prompt will be:

TYPES OF MAPS

1 - 7 1/2 MINUTE

2 - 15 MINUTE

3 - 30 MIN LAT x 1 DEG LON

4 - 1 DEG LAT x 2 DEG LON

5 - OTHER

ENTER TYPE: Enter the type of map desired for the output data base.

Successive prompts will ask for entry of one or more corner coordinates in the format indicated. The format for entry of the LAT/LON corners of the data base is the same as used for entry of data base corners when starting a GSMAP data base.

ENTER LAT/LON OF \_\_ CORNER

DD,MM,SS,C,DDD,MM,SS,C:

After the coordinates of the corners of the output data base have been established prompts will ask for the data bases to be merged into the output data base. The prompt is:

ENTER INPUT DATA BASE NAME:

The last prompt will be repeated as required to allow merging of a series of data bases into the output data base.

To return to the Main Menu, hit the Enter key instead of naming a data base to be merged into the output data base.

Cartesian prompts

GET CORNERS FROM AN EXISTING DATA BASE?(y/N): Answer Y or N, the default is N.

If Y the prompt will be:

ENTER DATA BASE NAME:

If N the prompt will be:

OPTIONAL METHODS FOR SPECIFYING DATA BASE CORNERS

- 1 - SPECIFY UPPER RIGHT CORNER (X,Y)
- 2 - SPECIFY LOWER LEFT (X,Y), UPPER RIGHT(X,Y)
- 3 - ALL FOUR CORNERS

ENTER OPTION:

These options ask for entry of the coordinates in X and Y just as in Option 1 of GSMAP, Cartesian data base. Follow the prompts, e.g., 1 then 8,10.

After the coordinates of the corners of the output data base have been established prompts will ask for the data bases to be merged into the output data base. The prompt is:

ENTER INPUT DATA BASE NAME:

ENTER XOFF, YOFF: Enter the X and Y offsets (in inches), e.g. 0,1.0.

ENTER XSCALE, YSCALE:SCALE FACTOR (X,Y): Enter the X and Y scale factors e.g. 0.5, 0.5 for merging of a drawing at half the digitized size.

ENTER ROTATION ANGLE:

Enter 0 if set is not to be rotated. The desired angle is entered for counterclockwise rotation about the lower left corner of the data base.

The last three prompts will be repeated as required to allow merging of a series of data bases.

To return to the Main Menu, hit the Enter key instead of naming a data base to be merged into the output data base.

## Option 8 - COMPUTE LENGTHS OF LINES OR AREAS AND PERIMETERS OF POLYGONS

This option enables computation and printing of the lengths of lines, codes 1-99 and 600-699, and the perimeters and areas of polygons, codes 400-499. Enter 8 in response to the prompt on the Main Menu, then answer each prompt in turn. Prompts:

ENTER INPUT DATA BASE NAME:

Enter the name of the data base. For geodetic data bases the prompts will be:  
ENTER FILENAME OF PROJECTION PARAMETERS (DATABASE.PRJ)?

The default (hit the Enter key) is a file with the name of the input data base and extension PRJ. After entry of the name of the projection parameter file, a prompt will then ask for the desired units:

PLEASE SPECIFY DESIRED UNITS:

- |                        |                                      |
|------------------------|--------------------------------------|
| 1 = KILOMETERS SQUARED | (lines and perimeters will be in Km) |
| 2 = SQUARE MILES       | (lines and perimeters will be in Mi) |
| 3 = ACRES              | (lines and perimeters will be in Mi) |
| 4 = HECTARES           | (lines and perimeters will be in Km) |

Specify your choice of units by entering 1,2,3, or 4.

The next prompt will select the output device:

OUTPUT ON SCREEN,PRINTER,DISK (S/p/d): Enter S, P or D. If you specify output to a disk (D) the screen will prompt (prompt skipped if S or P is entered):

ENTER DISK FILENAME FOR OUTPUT:

Enter the name of the file to be used for output.

After selection of the output device (and filename if output is sent to a disk), a prompt will ask for the code of the entries to be processed.

ENTER CODE(0 TO EXIT):

Enter the code of the entries desired. The lengths of lines, and areas and perimeters of polygons will be calculated and displayed on screen or on the printer as selected for geodetic data bases in the format below. A header will supply information on the units of length and area. An example is printed below.

For lines:

```
CODE 4 (ALL VALUES IN KM. )
ENTRY NUMBER = 342 LENGTH= 1.96
ENTRY NUMBER = 343 LENGTH= 0.85
ENTRY NUMBER = 471 LENGTH= 2.92
TOTAL FOR CODE 4 = 182.10
```

For polygons:

```
CODE 400 (AREA IN SQ.KM., PERIMETER IN KM.)
ENTRY NUMBER = 2
AREA OF EXTERIOR POLYGON = 0.59 PERIMETER = 3.42
AREA (EXT. - INT. POLYGONS) FOR ENTRY 2 = 0.59
ENTRY NUMBER = 4
AREA OF EXTERIOR POLYGON = 12.37 PERIMETER = 24.76
AREA OF INTERIOR POLYGON = 0.68 PERIMETER = 3.64
AREA (EXT. - INT. POLYGONS) FOR ENTRY 4 = 11.69
```

Areas are calculated to .XXX decimal places in the units selected, lengths to .XX decimal places in the units selected. Accuracy depends on the scale of digitizing and other factors that must be determined by the user of GSMUTIL.

For Cartesian data bases data display will be in the form below

**CODE 1 (LENGTH IN UNITS)**

ENTRY NUMBER = 10 LENGTH = 0.51

ENTRY NUMBER = 11 LENGTH = 3.24

**CODE 400 (AREA IN SQUARE UNITS, PERIMETER IN UNITS)**

ENTRY NUMBER = 16

AREA OF EXTERIOR POLYGON = 0.34 PERIMETER = 2.84

AREA (EXT.-INT POLYGONS) FOR ENTRY 16 = 0.34

TOTAL FOR CODE 400 = 0.34

For most Cartesian data bases the units are inches for lengths and square inches for areas. The units are established when starting the data base, and normally are those of the digitizer coordinates and therefore inches. Values for deleted entries will not be reported.

After all codes desired have been selected, the ENTER CODE(0 TO EXIT) prompt should be answered by specifying 0 to return operations to the Main Menu.

If there is some problem with the digital representation of a polygon, a label such as that below will follow the listing provided by this option (screen, hard copy, or disk).

**INVALID POLYGON = 12** (the number indicates the number of the entry in the data base). This may point out an error in the calculated value.

If the external polygon and internal polygon(s) do not close (identical first and last points) the **INVALID POLYGON** message will be displayed and the error in calculation of the error may be large.

If the polygon closes mathematically but the last two points have identical coordinates, the **INVALID POLYGON** message will be displayed but the area calculated for the polygon will be correct. Check the two coordinates for any suspect polygon provided by GSMAP using the listing, Option 7. If the coordinates for the first and last points of a polygon without internal polygons are identical the problem is probably due to duplicate points at the end of the entry. The data base can be processed using Option 9 of GSMUTIL to remove duplicate points. Filtering at map scale using a tolerance distance of 0.001 (inches) removed such points in a test data base without changing the values calculated for the polygon, and the error message was not generated when areas were calculated for the filtered data base.



## Option 9 - FILTER A DATA BASE INTO AN OUTPUT DATA BASE

Filtering a data base is done to remove duplicate points, reduce the number of points in lines to speed plotting and thus reduce the size of the data base. When data digitized for plotting at one size is to be plotted at a greatly reduced size, fewer points are "needed" to satisfactorily approximate curved lines. A data base with points producing satisfactory line work at a scale of 1:24,000 may contain many times the number of points required for a satisfactory plot at 1:100,000. When making geologic map compilations at small scale, scale changes by a factor of more than 10 are common. If digitizing is done using large scale maps, filtering of lines may be appropriate for smaller scale plots.

The selection of the lines to be plotted when changing map scales is a scientific matter, one not to be managed by a computer. The filtering of digitized points to reduce the number of points in a line, yet meet requirements for plots at smaller sizes can be done well by a computer because it requires selection of elements to be removed. The original (input) data base is not modified by these programs. A new (output) data base is created.

When operating the filter option, the user specifies a **TOLERANCE** distance. The program selects a series of points from each original line. The first and last points of the line are always selected. Intermediate points are selected to form a generalized line in such a way that all points in the original line are closer to the generalized line than the specified tolerance distance. The filtering algorithm used here was developed by Douglas, D. H., and Peucker T. K., (1973).

The section below is quoted from the source code and describes the operation of the Douglas-Peucker filter.

```
' *      THIS PROCEDURE IS AN IMPLEMENTATION OF THE DOUGLAS-PEUCKER      *
' * ALGORITHM FOR LINE GENERALIZATION (SEE 'ALGORITHMS FOR THE REDUC-    *
' * TION OF THE NUMBER OF POINTS REQUIRED TO REPRESENT A DIGITIZED      *
' * LINE OR ITS CARICATURE', BY D.H. DOUGLAS AND T.K. PEUCKER,          *
' * CANADIAN CARTOGRAPHER, VOL. 10, NO. 2, DEC. 1973, PP. 112-122.      *
' *                                                                      *
' *      THIS ALGORITHM SELECTS THE POINT IN THE LINE WITH THE GREATEST *
' * PERPENDICULAR DISTANCE FROM A MATHEMATICAL LINE BETWEEN THE ANCHOR *
' * (1ST POINT) AND THE FLOATER (LAST POINT). TWO LINES ARE FORMED,     *
' * ONE CONSISTING OF THE POINTS BEFORE THE POINT WITH THE GREATEST    *
' * PERPENDICULAR DISTANCE AND ONE CONSISTING OF THE POINT AFTER. EACH *
' * OF THESE LINES IS EXACTLY AS THE ORIGINAL LINE WAS, EACH POSSIBLY *
' * FORMING 2 MORE LINES. THE PROCEDURE CONTINUES UNTIL ALL POINTS      *
' * BETWEEN THE ANCHOR AND FLOATER ARE WITHIN A PRESET TOLERANCE FOR   *
' * EACH LINE PART. THE GENERALIZED LINE THEN CONSISTS OF ALL ANCHOR   *
' * AND FLOATER POINTS.                                                *
' *                                                                      *
```

To filter a data base Enter 9 in response to the prompt on the Main Menu, then answer each prompt in turn. Prompts:

ENTER INPUT DATA BASE: Enter the name of the input data base.

ENTER OUTPUT DATA BASE: Enter the name of the output data base.

ENTER FILENAME OF PROJECTION PARAMETERS: Enter the name of the projection file to be used for a geodetic data base. This prompt will be omitted for a Cartesian data base.

ENTER MAP SCALE: Enter the scale to be used as reference for filtering, e.g. 24000.

ENTER TOLERANCE (inches): Enter the tolerance distance in inches, e.g. .003

ENTER CODE TO BE SELECTED(-1=ALL, 0=EXIT):

Enter the code required. After entry of the code the program will operate. The "ENTER CODE TO BE SELECTED" prompt will return to enable selection of an additional code until a 0 is entered to end the session. Enter -1 to filter all lines codes 1-99 and 400-499 and also copy entries of all other codes to the output data base. After entry of -1 or 0 the program will operate and then will return the system to the DOS prompt .

Enter the tolerance distance in inches. Selection of a tolerance distance of 0.001 inch is equivalent to plotter resolution for the given scale; selection of 0.003 inch is about the width of a fine line. Plots made from data filtered at 0.002 inch seem indistinguishable from plots made from original data. Use the projection parameter file corresponding to the map projection that you expect to use for final plotting. The filter algorithm works in terms of distances and directions. For geodetic data bases the use of a different map projection different from that to be used for final plots may not produce the results that you want to achieve.

## Option 10 READ INPUT DATA BASE, SNAP NODES, AND CREATE AN OUTPUT DATA BASE

Option 10 processes entries of lines, codes 1-99 and 600-699, in Cartesian or geodetic data bases. It establishes a set of nodes for the data base by reading the end points of these lines in the sequence of entries in the data base, and snaps end points of these lines to the nodes if within a specified (snap) distance. A set of nodes for the data base is started by reading the end points of the first entry in the data base belonging to a code in this code group. The program then reads the end points of the next entry in this group, compares the coordinates of the end points of this line with those of the first entry, and establishes additional nodes if these one or both of the end points are not within the snap distance of an existing node. The process continues until the end points of all lines have been examined, and a set of nodes prepared on disk. When this set of nodes is complete, end points of entries belonging to these codes are examined, and if the coordinates are within the snap distance of a node, the coordinates of that point are changed to those of the closest node. This has the effect of exactly joining the ends of line segments at intersections. Because the end points on lines must be read twice and adjusted to the node coordinates, this process can be time consuming.

Use of Option 10 to process a data base may be desirable to attain precise joins at points where lines have been broken and new segments spliced. Node Snapping is useful if data bases are to be taken to other programs where lines that overshoot or undershoot intersections pose problems.

To make best use of this option we suggest that digitizing of lines should be from intersection to intersection (node-to-node), then ordering the data base using GSMUTIL, Option 1, and finally using Option 10 to snap nodes. For example, if straight lines forming a map border are contained in the data base, entries in these codes should be at the start of the data base so that end points will not be moved to accommodate ends of intersecting lines, thus keeping straight borders straight.

If a geodetic data base is to be processed, prepare the appropriate projection parameter file before starting GSMUTIL.

Select option 10 by entering 10, from the Main Menu, then respond to prompts as indicated below.

The next first prompt will ask for the name of the data base to be processed:

ENTER INPUT DATA BASE NAME:

ENTER OUTPUT DATA BASE NAME:

The next prompt for a geodetic data base will be skipped if the data base uses Cartesian coordinates.  
ENTER FILENAME OF PROJECTION PARAMETERS (.PRJ)?

ENTER MAP SCALE:

ENTER SNAP DISTANCE(inches):

A snap distance of .003 inch will usually accomplish desired snapping to nodes. Too large a snap distance risks loss of short line segments. Check your data base.

After entry of the snap distance the program will read the data base, then provide an information message:

THERE ARE XXX NODES IN THE DATA BASE.

Operation of the program will continue after this display, then return the system to the Main Menu after processing is complete.

## Option 11 - CONVERT A GEODETIC DATA BASE TO A CARTESIAN DATA BASE

Option 11 is used to generate an output data base in Cartesian coordinates from an input data base in geodetic coordinates. The "map" portion of an illustration can thus be prepared using geodetic coordinates so that the data base can be used to generate maps using different map projections, then exported to a data base that uses Cartesian coordinates and represents a specific map projection, the "collar" information, e.g. scale, north arrows, explanation, and other elements digitized in Cartesian coordinates and then merged with the "map" into position for publication. The proper projection file must be created before entering GSMUTIL. The Cartesian data base will be in X-Y coordinates and will match the chosen map projection.

Select Option 11 by entering 11 from the Main Menu. Reply to each prompt in sequence:

Prompts:

ENTER INPUT DATA BASE:

ENTER OUTPUT DATA BASE NAME:

ENTER FILENAME OF PROJECTION PARAMETERS

ENTER MAP SCALE FOR X,Y:

Enter the scale that would be used for the map if plotted using the geodetic data base to achieve the desired size for the map, e.g. 24000.

ENTER XOFFSET,YOFFSET:

Enter offsets desired. 0,0 for offsets will place the lower left corner of the geodetic data base near the 0,0 corner of the Cartesian data base.

The lower left corner of the Cartesian data base will have the coordinate 0,0. The vertical direction of the geodetic data base will be established by the projection file used. It will correspond to the vertical direction in a geodetic plot of the data using the same projection file. The coordinates of the corners of the Cartesian data base will include all points inside the geodetic data base corners.

## Option 12 - CONVERT A CARTESIAN DATA BASE TO A GEODETIC DATA BASE

Option 12 is used to generate an output data base in geodetic coordinates from an input data base in Cartesian coordinates. The latitude and longitude of each of the data base corners and the map projection for the map must be known. The projection parameter file must be prepared before entering GSMUTIL. Select Option 12 by entering 12 from the Main Menu screen.

Prompts:

ENTER INPUT DATA BASE NAME:

ENTER OUTPUT DATA BASE NAME:

ENTER FILENAME OF PROJECTION PARAMETERS (.PRJ)

ENTER LAT/LON OF NORTHWEST CORNER  
DD,MM,SS,C,DDD,MM,SS,C

ENTER LAT/LON OF SOUTHWEST CORNER  
DD,MM,SS,C,DDD,MM,SS,C

ENTER LAT/LON OF SOUTHEAST CORNER  
DD,MM,SS,C,DDD,MM,SS,C

ENTER LAT/LON OF NORTHEAST CORNER  
DD,MM,SS,C,DDD,MM,SS,C

After entry of the geodetic coordinates of the last (northeast) corner, the program will operate, and when operations are complete return operation to the Main Menu. The format of data entry for data base names, names of projection files, and of geodetic coordinates for the four corners follows standard GSMAP practice. The geodetic coordinates for the corners and the parameters for projection files must be exact. Close isn't good enough, precision here must be comparable with the precision of entering the corners when digitizing.

### Option 13- GENERATE AN OUTPUT DATA BASE CONTAINING A GRID OF LINES

Option 13 generates line segments in GSMAP format that form a geodetic grid for an area defined by geodetic coordinates, or a Cartesian grid in an area defined by Cartesian coordinates. When using geodetic coordinates, the user selects the latitude coordinates for the southern and northern boundaries, the longitude coordinates for the western and eastern boundaries, the spacings desired between lines of latitude and longitude, and the code to be used in the output data base. We suggest the use of codes 1-99. This option generates a geodetic data base in GSMAP format with corners defined by the latitude and longitude values specified, and containing a series of line segments (coded as specified) that form a geodetic grid spaced as specified. Each segment along a lines of latitude or longitude corresponds to the length of the grid spacing specified and is defined by 11 points. You may find problems if you specify grid intervals that don't fit evenly into the area specified.

Prompts when generating a grid defined by geodetic coordinates:

ENTER TYPE OF UNITS (GEODETIC OR CARTESIAN (G/C):  
ENTER OUTPUT DATA BASE NAME  
ENTER TITLE FOR OUTPUT DATA BASE:  
ENTER CODE FOR OUTPUT SEGMENTS:  
ENTER SOUTHERN BOUNDARY(DD,MM,SS,C:  
ENTER NORTHERN BOUNDARY(DD,MM,SS,C):  
ENTER DELTA LATITUDE(DD,MM,DD):  
ENTER WESTERN BOUNDARY(DDD,MM,SS,C):  
ENTER EASTERN BOUNDARY(DDD,MM,SS,C):  
ENTER DELTA LONGITUDE (DD,MM,SS):

Prompts on the screen follow GSMAP conventions, including the use of Compass direction so that West (W) and East (E) longitudes, and North (N) and South (S) latitudes may be specified.

Corresponding entries are required to generate a data base containing a grid in Cartesian coordinates. Normally, the units would be in inches.

The line segments generated by this option can be joined into polygons using GSMPBLD or GSMPBS.

## Option 14- PREPARE A TABLE OF CODES THAT OCCUR IN A DATA BASE

Option 14 provides a listing in an ASCII file of all of the codes used in a data base and the number of entries of each code. This type of listing is useful when working with unfamiliar data bases, as a check against codes listed in the plot control file, and quickly finds codes entered by mistake during digitizing. The prompts are simple.

### ENTER INPUT DATA BASE NAME

Enter the name of the data base.

### ENTER FILENAME FOR OUTPUT ASCII TABLE

Enter the name of the file to be used for the output. The first column of the file is the code, the second, the number of entries. An example is printed below.

|     |    |
|-----|----|
| 50  | 4  |
| 8   | 1  |
| 7   | 1  |
| 5   | 1  |
| 1   | 4  |
| 11  | 2  |
| 400 | 1  |
| 401 | 1  |
| 603 | 1  |
| 101 | 3  |
| 201 | 1  |
| 221 | 1  |
| 202 | 2  |
| 222 | 1  |
| 205 | 1  |
| 210 | 1  |
| 300 | 9  |
| 555 | 10 |
| 701 | 3  |

## Option 15-READ A GSPOST FILE AND CREATE AN OUTPUT DATA BASE

Refer to p. \*\*\* for a description of GSPOST and the data files that it requires, including a description of formats. Option 15 is designed to bring data from a GSPOST data file into a form that can be used for posting by the GSMAP program. A user specified code in the 100-199 code group is used in the GSMAP data base and a table QF.

in form suitable for posting from GSMAP is created as a part of the output of this option. Prompts and responses are listed below in sequence.

### ENTER FILENAME FOR INPUT GSPOST FILE

Enter the name of the data file in GSPOST format.

### DOES THIS FILE CONTAIN GEODETIC OR CARTESIAN COORDINATES(G/C):

Enter G (geodetic coordinates) or C (Cartesian coordinates) to specify the coordinate system used in the data file. The next prompt will be skipped if Cartesian coordinates are being used.

### ENTER FORMAT OF GEODETIC COORDINATES (DD OR DMS):

Enter DD if the decimal degree format is used in the geodetic data file, DMS if degree, minute, second, compass direction format is used.

### ENTER #ROWS,#DATA COLUMNS,TEXT LINES:

Enter the number of rows, data columns, and lines of text used as header records are used in the data file, e.g., 358,5,1

### ENTER OUTPUT DATA BASE NAME:

Enter the name to be used for the GSMAP data base.

### ENTER TITLE FOR OUTPUT DATA BASE:

Enter the title for the GSMAP data base.

The next prompts specify the coordinates of the corners to be used for the GSMAP data base. The sequence is the same as that of Option 1 GSMAP, START A NEW DATA BASE. The example below is the prompt for starting a geodetic data base.

### TYPES OF MAPS

1 - 7 1/12 MINUTE

2 - 15 MINUTE

3 - 30 MIN LAT x 2 DEG LONG

4 - 1 DEG LAT x 2 DEG LONG

5 - OTHER

### ENTER TYPE:

Enter the type of map. In this example, if types 1-4 are specified, the next prompt will be:

### ENTER LAT/NON of NORTHWEST CORNER

DD,MM,SS,C,DDD,MM,SS,C:

Enter the coordinates of the required corner or corners (type 5), e.g. 41,0,0,N,116,0,0,W.

### ENTER GSMAP CODE TO ASSIGN (100-199)

Enter the code to be used for the data points in the GSMAP data base, e.g. 111.

### ENTER FILE NAME FOR REFORMATTED DATA MATRIX:

Enter the name of the file to be used for the reformatted data. The program will operate, then return to the main menu.



The following parameters from the GSPOST data file are used to generate the GSMAP data base. The header records in the GSPOST file are ignored, the coordinates of each point are used for the first point of the entry, coordinates of the alternate posting position (if there is one) are used for the second point of the entry, the rotation angle is used for P2 of the entry, the number of the row is used for P1.

Requirements for GSPOST data files and for GSMAP data files to be used by 100-199 codes are different. A reformatted file meeting GSMAP specifications is created with the name provided by the response to the last prompt. Differences are summarized below:

| GSPOST                                         | GSMAP                                                               |
|------------------------------------------------|---------------------------------------------------------------------|
| Header records                                 | No header records                                                   |
| Alphanumeric locality identifier               | Numeric locality identifier                                         |
| Location coordinates in file                   | Location recorded in GSMAP data base Point #1                       |
| Control column for rotation                    | Rotation defined by P2 in GSMAP data base                           |
| Control columns for alternate posting position | Alternate posting position is point #2 for entry in GSMAP data base |
| Data columns must be numeric                   | Data columns can be alphanumeric                                    |

The identifier in the GSPOST data base is used for data column #1 in the GSMAP data matrix. The number of the data column for each data column in the GSPOST data base is increased by one in the GSMAP data matrix, e.g. data column #3 in the GSPOST data file becomes #4 in the GSMAP matrix. The examples below show the changes made from the input data table to the output matrix. The examples below show the GSPOST and GSMAP tables for one brief example as a comparison.

#### GSPOST input table:

| ELKO     |   | LATITUDE | LONGITUDE  | ROT | ALT/POST | ALT/POST | Ti      | Fe      |
|----------|---|----------|------------|-----|----------|----------|---------|---------|
| "CC413SS | " | 40.11446 | -114.77170 | 0   | 0.00000  | 0.00000  | 0.20000 | 2.00000 |
| "CC414SS | " | 40.07556 | -114.78390 | 0   | 0.00000  | 0.00000  | 0.20000 | 1.00000 |
| "CC415SS | " | 40.02861 | -114.82580 | 0   | 0.00000  | 0.00000  | 0.20000 | 2.00000 |
| "CC414   | " | 40.07556 | -114.78390 | 0   | 0.00000  | 0.00000  | 0.50000 | 2.00000 |
| "CC413   | " | 40.11446 | -114.77170 | 0   | 0.00000  | 0.00000  | 0.50000 | 2.00000 |

#### GSMAP output matrix:

|   |          |   |          |         |
|---|----------|---|----------|---------|
| 1 | "CC413SS | " | 0.20000, | 2.00000 |
| 2 | "CC414SS | " | 0.20000, | 1.00000 |
| 3 | "CC415SS | " | 0.20000, | 2.00000 |
| 4 | "CC414   | " | 0.50000, | 2.00000 |
| 5 | "CC413   | " | 0.50000, | 2.00000 |

## Option 16-GENERATE DOUBLE LINES FROM A SINGLE TRACE FOR SPEC. CODES

This option permits the user to read data from an input GMAP data base, select lines with one code or all codes (for lines), then create an output data base containing doubled lines, one on each side of digitized single traces. The option was designed to permit digitizing the centerlines of features of constant width such as roads or dikes and generating parallel lines from the single digitized trace. This option produces results much like plots for which Line Type 98 is selected, but these lines can be edited and intersections modified, or used to form polygons as the user wishes.

Select this option by entering **16** in response to the prompt on the Main Menu, then respond to each prompt in turn. Prompts:

ENTER INPUT DATA BASE NAME:

ENTER OUTPUT DATA BASE NAME:

If a geodetic data base has been selected the next two prompts will be seen (skipped if a Cartesian data base):

ENTER FILENAME OF PROJECTION PARAMETERS:

ENTER MAP SCALE:

ENTER DELTA (inches):

ENTER CODE TO BE SELECTED -1=ALL, 0=EXIT

After responses to these prompts have been entered, the program will operate, then return to the Main Menu screen.

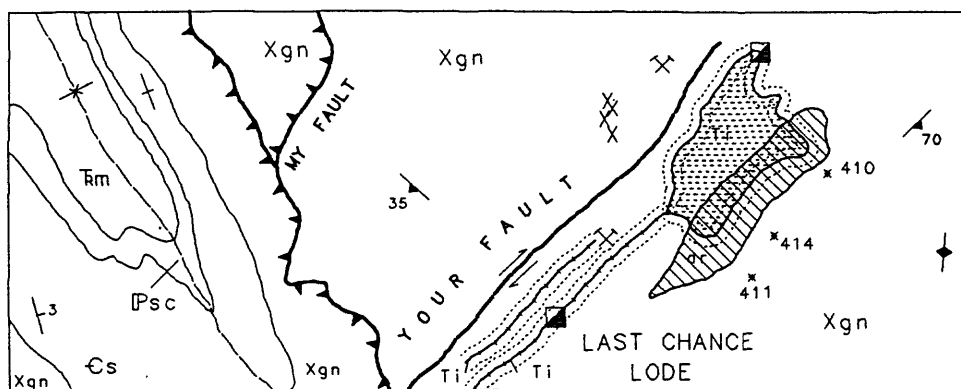


Figure 11, dotted lines drawn 1,000' from contact between Ti and host rock

## Option 17-GENERATE SPLINED LINES FROM LINES OF SPEC. CODES

This option permits the user to read data from an input GSMAP data base, select lines with one code or all codes (for lines), then create an output data base containing splined lines (smoothed by adding points by fitting to a cubic spline (equation). This option produces results much like plots for which codes 600-699 have been selected, but these splined lines can be edited, filtered, and otherwise processed. This process is not designed to "improve" poor digitizing, only to smooth lines where too few points have been digitized for use at an output scale. Appropriate use rests with the scientific acumen of the cartographer. Filtering after splining using option 9 is strongly suggested, as is checking plots of the processed lines against the original materials.

Select this option by entering 17 in response to the prompt on the Main Menu, then respond to each prompt in turn. Prompts:

ENTER INPUT DATA BASE NAME:

ENTER OUTPUT DATA BASE NAME:

If a geodetic data base has been selected the next prompt will be seen (skipped if a Cartesian data base):

ENTER FILENAME OF PROJECTION PARAMETERS:

ENTER CODE TO BE SELECTED -1=ALL, 0=EXIT

After responses to these prompts have been entered, the program will operate, then return to the Main Menu screen.

## Option 18 - EXIT

Entry of 18 returns the system to the DOS prompt.

## POLYGON BUILDING PROGRAM, GSMPBLD

Version 9 of GSMPBLD automatically assembles polygons for the entire map area and provides them with attributes based on attributes of a point within each polygon. The price for this automatic assembly is great care in preparation of the data bases used for the process. Previous versions of GSMPBLD took digitized lines from a geodetic or Cartesian input data base and assembled these lines into closed polygons or composite lines using a digitizer as a pointing device to identify the lines. This kind of polygon building by pointing at lines is now best done on the screen using GSMPBS.

### Preparation of data bases for use with GSMPBLD

Create a data base consisting of the lines to be used for assembly of polygons and no others (node-to-node digitizing is required), and label points to identify each polygon. Use a single and unique code for the lines (such as quadrangle margins) that form the boundaries for the area. For label points use code in the 500-599 group such as 555 and a P1 value equal to the code you wish assigned to the polygon (400-499, 800-888. A code of 899 will be assigned to unlabeled polygons. If digitizing of a map is complete, needed lines and label points can be selected from the main data base using option 1 (select a subset) of GSMUTIL, then by using GSMEDIT to delete unneeded lines and/or to add labels. The edit option of GSMEDIT program can also be used to break lines into shorter segments if the shorter segments are needed to build polygon boundaries. The purpose is to prepare a data base that includes lines to be used as polygon boundaries with all nodes snapped, and one label point per polygon and nothing else. Although the majority of this editing can be done on the screen, a final hard copy plot for checking is probably desirable.

After this data base (lines plus labels) has been checked, use Option 1 (subset) of GSMUTIL to create a data base containing lines only and a second containing labels only. These data bases will be the input data bases used by GSMPBLD. They should not contain deleted entries, lines with dangling nodes, or any extraneous entries.

### Operation of GSMPBLD

The program file GSMPBLD.EXE, the two data base files, and the projection parameter file for the data base must be available. Turn on the printer attached to the computer (LPT:1). Error messages will be printed if there are problems with the data sets.

Start the GSMPBLD program by entering GSMPBLD.

A disclaimer screen will be shown for a second, then prompts will be displayed. Respond to each in turn.

ENTER INPUT DATA BASE NAME: Enter the name of the data base containing the lines to be used for polygon borders.

ENTER FILENAME OF PROJECTION PARAMETERS (\_\_.PRJ)? (prompt omitted if data base uses Cartesian coordinates). Enter the name of the projection file

ENTER CODE OF BOUNDARY LINES: Enter the code of the lines that form the boundary around the polygons to be assembled. For a quadrangle, these would be lines along the quadrangle border.  
DO YOU WANT TO CONTINUE?(Y/N): Respond Y to continue.

A message will provide information; if polygon creation is successful, the message will be:

POLYGON BUILDING COMPLETED

FOLLOWING REQUEST IS FOR LABEL POINT DATA BASE

ENTER INPUT DATA BASE NAME:

Enter the name of the data base containing the label points.

After this entry a message will provide the number of attribute (label) points, let you know that the output data base is being created, then ask for the name you wish to use for the output data base:

ENTER OUTPUT DATA BASE NAME: Enter the name of the output data base.

The writing of the output data base may take some time. The largest polygon will be written first, and so will probably take the longest to form.

#### Messages on the printer

If all was in order, the message will be:

FOLLOWING NODES HAVE ONLY ONE LINE ATTACHED  
CHECKING FOR DUPLICATE LINES  
FOLLOWING LABEL POINTS WERE UNUSED

If problems were encountered, values for dangling nodes, duplicate lines will be indicated, and unused label points will be printed. If no label point was found within a polygon, a code of 899 will be assigned.

If there were problems go back to the data base containing lines and labels, fix the problem(s), split the data into the two data bases needed b GSMPBLD, then run GSMPBLD again. This will ensure that there are no deleted lines in the data bases used by GSMPBLD.

#### Things to consider

If leaders are used with a label point, points 3, 5, 7.. are used, so point leader lines into the polygon, not away from it. Point 1 will be used as the label point if no leader is attached, but won't be if a leader is provided.

Should you create neighboring polygons with the same attribute (CODE)?, the smallest polygons ?, or the largest, if there is a choice? Consider this choice when choosing lines that make up the data base. GSMPBS considers all lines as a single coverage. Overlapping polygons should be formed in separate coverages.

Remember that the 5,000 point limit to the number of points defining a single entry applies to polygons, and that exterior and interior polygons count against this limit.

## POLYGON BUILDING PROGRAM GSMPBS

GSMPBS is a program that builds polygons or composite lines in a GSMAP output data base from line segments in an input GSMAP data base (geodetic or Cartesian). Line segments are selected by using the screen display. No digitizer or plotter is required. Either the arrow keys or a mouse can be used as the pointing device to select lines from the screen. We recommend using GSMPBS with VGA or EGA color graphics systems. Although it can be operated with CGA graphics, we do not recommend its use with CGA systems.

GSMPBS is similar in function to the GSMPBLD program except that GSMPBLD requires use of a digitizer to select line segments from hard copy.

### GSMPBS or GSMPBLD ?

GSMPBS requires a computer with EGA or VGA graphics, and is best with color systems. It is convenient and easy to operate. Although its use is limited by the size of the polygon and the resolution of the screen, its ability to change windowed areas during the building of a polygon and preview and confirm each selected line during operation provides significant advantages. GSMPBLD is most appropriate for assembly of polygons covering the entire data base area e.g. forming a complete coverage, but requires more time for preparation of input data bases.

When using GSMPBS the on-screen cursor is moved using the keys on the numeric keypad or a mouse. The lines to be assembled are identified in the sequence in which they are to be assembled. A function chosen using keys on the keyboard is used to specify whether the line is one in the sequence outlining the polygon or making up a composite line, ending a line, closing a polygon, or completing the last polygon of a complex polygon with an external polygon and one or more internal polygons.

Closing of polygons and joining of line segments into continuous lines is done by the program. Line segments need not have been "snapped" to join or combine into closed polygons. Lines and polygon outlines are highlighted on the screen after selection and final assembly.

### Preparation of a digital data base for use with GSMPBS

Create a data base consisting of lines to be used for assembly of new entries. This can be done using option 1 (select a subset) of GSMUTIL. The object is to reduce the size of the data base and speed operations. Check to see that the segments that you wish to assemble are available. If uncertain, make a draft mode plot to find the ends of lines. The edit option of GSMAP or the GSMEDIT program can be used to break long lines into shorter segments if the shorter segments are needed for polygon building.

Hard copy may be useful to assist the process of choosing lines, but is not required for operation of GSMPBS.

### Required files for use of GSMPBS

The program file GSMPBS.EXE and The CONFIG9.SCR file configured to match the computer's graphic system must be in the active directory unless the environmental variable GSFILES = specifies otherwise.

## Operation of GSMPBS

The input data base, a plot control file, and a projection parameter file (if geodetic coordinates are used by the input data base) must be available before starting the GSMPBS program.

Start the program by entering **GSMPBS**

A disclaimer screen will be displayed briefly, then prompts, answer each in turn, as in GSMAP:  
**ENTER INPUT DATA BASE NAME:**

**ENTER PLOT CONTROL FILENAME (INPUT DATABASE.PLT):?**

**ENTER FILENAME OF PROJECTION PARAMETERS(INPUT DATABASE.PLT):**  
This prompt will be displayed only if the input data base uses geodetic coordinates.

**ENTER OUTPUT DATA BASE NAME:**

After entry of the output data base name, the lines in the input data base and polygon outlines will be displayed on the screen, with colors as specified by pen number in the plot control file. Ends of lines will be marked by small red blocks. Symbols and text will not be displayed. When the screen display has been completed ( building of the display can be terminated using the F9 and Q keys), the right side of the display will furnish a reminder of the use of keys in building polygons and the prompt:  
**ENTER CODE(999 TO EXIT,B= WINDOW,C= ZOOM OUT,D= ORIG.WINDOW):?**

Enter **B** to window, and window as described below. When the view on the screen is satisfactory, enter the code of the line or polygon that you wish to assemble, then the values for P1 and P2 that you wish (normally 0, hit the ENTER key). The screen will change to display a list of functions to be chosen by hitting the designated **hot key** highlighted on the screen.

### FUNCTIONS

**B=WINDOW**  
**C=ZOOMOUT**  
**D=ORG.WND**  
**E=RESTART**  
**0=SELECT**  
**1=END LIN**  
**2=END POL**  
**3=END INT**

**ENTER DESIRED FUNCTION**

**USE HOT KEYS TO SELECT**

The **B** window function is used to set a window using either the keypad or a mouse to select the lower left and upper right corners.

The **C** zoom out function is used to enlarge the area viewed on the screen up to the limits set by the data base corners. Hitting the **C** key will enlarge the area in the window by 25 percent, up to the limits set by the data base corners.

The **D** original window function is used to return the view on the screen to that set by the data base corners.

The **E** restart function is used to return the system to the enter code prompt. The window on the screen will not change.

The use of the numeric functions in the selection of lines resembles the use of keys when digitizing with GSMAP and GSMPBLD:

The 0 function is used to select a line, then to continue to select lines for the polygon.

The 1 function is used to select a line and end the entry with the selected line.

The 2 function is used to select a line, close a polygon, and end the entry.

The 3 function is used to select a line, close a polygon, then be able to continue assembling the entry, e.g, to close an external polygon, then continue and add one or more internal polygons.

If a mistake is made before completing an entry, use the E function to "escape" back to the point where a code is to be entered.

Cursor movement, keyboard mode:

The cursor can be moved either in Fast mode or Slow mode.

In fast mode the cursor moves in 20 pixel increments, in slow mode, one pixel at a time. The cursor is moved on the screen using the arrow keys on the numeric keypad for lateral and vertical movements, and the Home, End, PgUp and PgDn keys for diagonal movements (the Num lock must be OFF). The corners for the window can be set outside the area seen on the screen, albeit blindly as the + cursor cannot be seen.

|                     |       |
|---------------------|-------|
| →                   | right |
| ←                   | left  |
| ↑                   | up    |
| ↓                   | down  |
| Home=up and left    |       |
| End=down and left   |       |
| PgUp=up and right   |       |
| PgDn=down and right |       |

Cursor movement, mouse mode:

If a Microsoft-compatible mouse has been installed, the distinctive mouse cursor will be seen on the screen, and the mouse moved to the position desired. The mouse cursor cannot be moved outside the limits of the screen window.

## Windows

Hit the B key to select the window function. As increments of position are limited to one pixel on the screen when selecting lines, windowing is generally desirable. After hitting the B key a + cursor will appear on the screen near the lower left corner of the edit window. The + sign is the cursor. It is moved from the initial position using the arrow keys on the numeric keypad and/or the Home,End,PgUp and PgDm keys for diagonal movements.

The prompt line ENTER LOWER LEFT CORNER will be positioned below the lower left corner of the screen window. In keyboard mode move the cursor to the lower left corner of the desired window using the appropriate keys on the numeric keypad. Hit the ENTER key to establish the position of the lower left corner of the window, in mouse-mode click the left mouse key, a + will mark this position. In keyboard mode this will bring a second cursor + to the upper right corner of screen window. Either will bring the prompt ENTER UPPER RIGHT CORNER:



In keyboard mode, move the second cursor to the upper right corner of the desired window using the appropriate keys on the numeric keypad, in mouse mode a + will mark the lower left corner; the mouse is then used to move the mouse cursor to the desired upper right corner. When properly positioned, hit the ENTER key or click the left mouse key to establish the position of the upper right corner of the window. Lines and polygon outlines (not text or symbols) in the data base inside the window will be plotted on the screen. The proportions of the window box will change to correspond to the window specified. The windowing process can be continued until the desired window has been set.

## FUNCTIONS

**B=WINDOW**  
**C=ZOOMOUT**  
**D=ORG. WND**  
**E=RESTART**  
**0=SELECT**  
**1=END LIN**  
**2=END POL**  
**3=END INT**

**ENTER DESIRED FUNCTION**

**USE HOT KEYS TO SELECT**

### Selection of lines

Hit 0, 1, 3, or 3 to select the "function desired; 0 for a needed line, 1 if it is to be a line ending a composite line, 2 to select the last line for a closed polygon, 3 if an internal polygon is to be completed (closed) with this line, but selection of lines to complete the polygon is to continue. The prompt will request, **IDENTIFY LINE.**

Use the numeric keys or the mouse to move the cursor to a point on the desired line; identify the line by hitting the ENTER key or clicking the left mouse key. The computer will search for the nearest line, identify it by highlighting it on the screen and list the CODE, P1, and P2 values near the right corner of the screen. The prompt will change to:

**C=CONFIRM, SPACE BAR=CONTINUE SEARCH, X=EXIT**

Hit the C, Space Bar or X keys, as appropriate, and continue to select lines for the polygon in the sequence that you wish them assembled.

After identification of the lines has been completed by selecting the 1 or 2 function to identify the last line, and the line confirmed, The outline of the composite line or polygon will be highlighted as a bright yellow line. The screen will then prompt:

**PLEASE CONFIRM (C KEY) or REJECT (D KEY)**

If you confirm by hitting the C key the polygon will be added to the output data base. If the D key is used to reject an improperly formed polygon the polygon will not be added to the output data base. In either case screen will change to the ENTER CODE PROMPT, and the highlighted outline will revert to the original colors for the line segments.

If the polygon as formed has generated line segments that are not a part of the input data base, as for example to close a polygon, these highlighted segments will remain in yellow on the screen. As they are not a part of the input data base, they cannot be used to build polygons. It is best to refresh the screen or re-window to get rid of these extraneous segments before building other polygons.

During the line-by-line building process, new windows can be selected using the B, C, and D functions so that the parts of the screen appropriate to the task at hand can be viewed as each line is selected.

## GSMEDIT

GSMEDIT is a program used to edit GSMAP Version 9 data bases, either geodetic or Cartesian coordinates, using the screen and the keyboard of the computer. It also is an excellent way to view a data base on the screen because portions of the data base can be selected by windowing and examined in detail. The functions of this programs are much the same as the edit sequence in Option 3 of GSMAP, but do not require use of a digitizer or a hard copy plot. Entries or points can be deleted; points moved; CODE, P1 = P1, and P2 = P2 changed for entries; lines broken into segments, points in a line reversed in sequence, nodes edited (moved or deleted). Points and nodes can be viewed on the screen if desired. As with the other level 9 programs, configuration and font files can be installed in a directory specified by setting the environmental variable GSFILES to the desired directory.

### Required files

The following files must be prepared before starting the GSMEDIT program:

#### Data base files:

DATABASE.LSF DATABASE.NDX, and DATABASE.NOD for the data base being edited. Because these files are modified during editing we recommend that backup copies be made before editing is started.

#### Projection file:

A file containing map projection parameters (projection file) is required if the data base uses geodetic coordinates.

#### Plot control file:

A plot control file for the data base being edited is required. This file is used to specify parameters so that lines, symbols, and text can be correctly drawn on the screen and to provide a scale for geodetic data. If text and data files are not in the default area, specify the drive as well as the name of the file, e.g. A:DATABASE.RU. If the plot control file specifies draft mode, small circles will be drawn around the first and last points of each line and polygon (codes 1-99, 400-499, 600-699).

#### Text and data files:

Text and data files in standard GSMAP format as specified in the plot file.

### Zoom and windowing

During editing a section of a map can be enlarged on the screen by windowing that area to fill the screen, just as in GSMAP. The term zoom and the factors XZM and YZM are used to describe the degree of enlargement on the screen created by windowing during editing. When opening a data base the program scales the screen graphics to best fit the screen window. The XZM and YZM zoom factors (for X and Y respectively) are defined as 1 at for this first display. The amount of zoom introduced by subsequent windowing is calculated as linear magnification relative to this first display. Zoom factors are limited to enlargement less than 500, in X and Y (XZM and YZM). This limit was established to avoid numerical overflow that can occur if unlimited zoom is allowed. During editing the screen display will show the XZM and YZM factors as well as familiar GSMAP information on CODE, P1, and P2 for selected entries.

Example of scaling and zoom factors: A data base with the dimensions of a  $1^0 \times 2^0$  quadrangle is first displayed on the screen at about 1:1,000,000 scale. If the XZM and YZM factors are adjusted to 2, by windowing, the linear scale is about 1:500,000, and one fourth of the area is shown on the screen. For precise matching of points with a data base of these dimensions, XZM and YZM factors in the range 300-400 are required. The required zoom factor is dependent on the dimensions of for the data specified in the plot control file: the smaller the dimensions, the lower the required zoom.

## Resolution

Increments of cursor position on the monitor are quantized to pixel positions at the time of editing, as when entering the new position for a point that is to be moved. Enlargement on screen created by windowing is essential to accurate editing.

### Cursor movement:

Using the keyboard, the cursor can be moved either in Fast mode or Slow mode.

In fast mode the cursor moves in 20 pixel increments, in slow mode, one pixel at a time. The precise positioning required for editing such as selection of a new position for a point should always be done using the slow mode. The mouse moves its cursor pixel by pixel, but may be difficult to position precisely.

### Cursor movement using the keyboard:

The cursor is moved on the screen using the arrow keys on the numeric keypad for lateral and vertical movements, and the Home, End, PgUp and PgDn keys for diagonal movements (the Num lock must be OFF):

|                     |       |
|---------------------|-------|
| →                   | right |
| ←                   | left  |
| ↑                   | up    |
| ↓                   | down  |
| Home=up and left    |       |
| End=down and left   |       |
| PgUp=up and right   |       |
| PgDn=down and right |       |

### Cursor movement using the mouse:

The cursor is moved on the screen by moving the mouse. A point (position) is selected by clicking the Left Button on the mouse.

## Differences between GSMAP and GSMEDIT screen plots

The corners of screen plots drawn using GSMAP Option 8 are the corners specified in the plot control file. Entries with all points outside the specified corners will not be drawn. Entries with codes not specified in the plot control file will not be plotted.

The corners of screen plots drawn using GSMEDIT are the corners specified in the plot control file. All entries in the data base will be drawn, whether specified in the plot control file or not. If a code for a line or a polygon is not specified in the plot file it will be drawn as a solid line (yellow on a color EGA or VGA monitor). Entries for codes not specified in the plot file 100-399, 500-599, 700-799 will be drawn as points (multi point entries 700-799 as lines).

## Selection Criteria

Selection of an entry for edit can include examination of all entries regardless of code or of a single code. The prompt ENTER CRITERIA calls either for entry of the code of the desired entry or of A for all, to select an entry from all codes in the data base. Enter either the code of the desired entry or A = all to select from entries of all codes. Specification of a particular code will greatly speed the identification process.

## Operation

Start the program by entering **GSMEDIT**. During display of the disclaimer screen the symbol definitions in the file **CONFIG9.SYM** and characters in the file **0.FNT** will be loaded into core memory, then the screen will clear and files with extension **NDX** in the active area will be listed on the screen to provide information on data bases in the active area. The first prompt will call for entry of the name of the data base to be edited:

**ENTER DATA BASE NAME:?**

Enter the name of the data base to be edited without file extension(s). A prompt may ask if the data base uses geodetic coordinates or Cartesian coordinates. If this prompt is shown, enter **G** or **C** as a response. The screen will then display the title of the data base and the coordinates of the corners of the data base, and the prompt, Press any key to continue (hit the space bar). The next prompt differs depending on whether geodetic or Cartesian coordinates are being used. If geodetic, a later prompt will request entry of the name of the projection parameter file, but if Cartesian, this prompt will be skipped. In either case the following prompt will ask for entry of the name of the plot control file, and a list of the files with extension **.PLT** in the active area will be displayed:

**ENTER PLOT CONTROL FILENAME (DATABASE.PLT):?**

Enter the full name of the plot control file. The next prompt will ask for entry of the edit distance and supply a default value. This default value is a number in inches; the map scale is specified in the plot control file:

**ENTER EDIT DISTANCE (0.1):**

The edit distance is a specification of the maximum distance that the cursor can be from an entry and yet select it; beyond this distance entries will not be identified. The default value for the edit distance of 0.1 inch is selected by hitting the **Enter** key.

A prompt will show you the size of the map and ask if you want to continue:

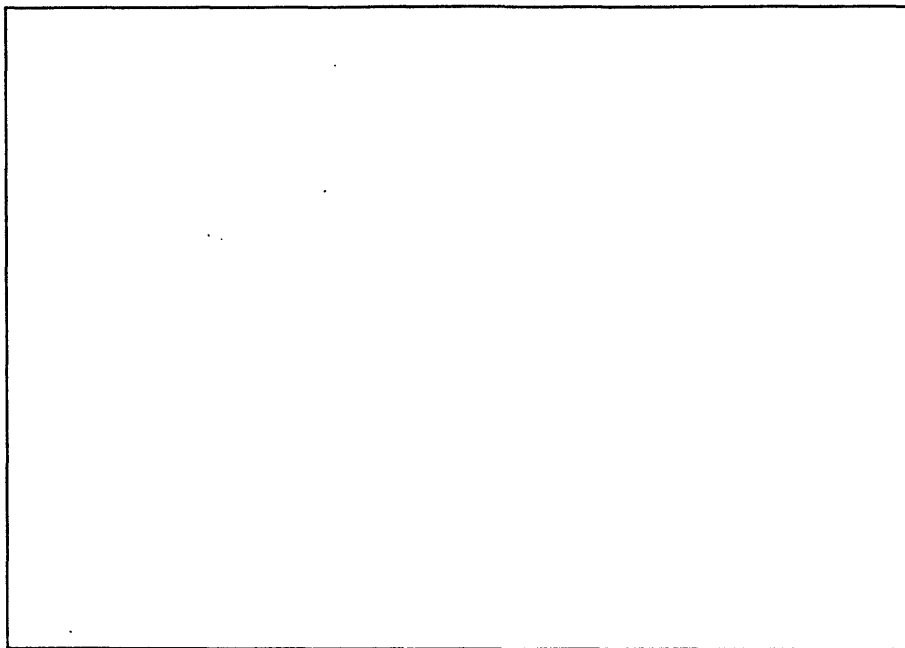
**MAP SIZE(X,Y)= 6.89 4.36**

**DO YOU WANT TO CONTINUE?(Y/n):**

Hitting the **Y** key or the **ENTER** key to select the default of **Y** allows you to continue.

The **E=EDIT DS** option on the **EDIT** screen allows change of the edit distance without leaving the program.

After entry of the edit distance and indicating that you want to continue, the data in the data base will be drawn on the screen. The corners of the data base will be used to define the area plotted on the screen. Messages on the right side of the screen prompt steps in the edit process, as on the next page.



FUNCTIONS  
A=SELECT  
B=WINDOW  
C=ZOOMOUT  
D=ORIG.WINDOW  
E=REFRESH  
F=EDT DST  
G=TOG.GRD  
H=CH.MODE  
I=MEASURE  
J=EDT NOD  
K=TOG.DET  
M=DOS COM  
X=EXIT

X ZM. 1  
Y ZM. 1

ENTER DESIRED FUNCTION

USE HOT KEYS TO SELECT

If you want to end the process of drawing on the screen before all data has been displayed, hit the F9 key, then the Q key, and proceed with editing.

The X ZM. 1 and Y ZM. 1 annotations on the screen are the initial X and Y zoom factors (defined as equal to 1 at the start of editing).

Hitting hot keys (ENTER key not used) selects functions to be pursued from a list of options.

Hit A to select an entry for editing

Hit B to select a window on the screen.

Hit C to zoom out (set window 25% greater in both X and Y).

Hit D to return to the original window (view at the start of a session).

Hit E refresh the screen (may be useful during editing after changes).

Hit F change the edit distance, the default is 0.1 inch as shown by the prompt.

Hit G to draw a grid on the screen, toggle it on or off.

Hit H to change from edit mode to input mode for digitizing.

Hit I to measure position, distance, bearing.

Hit J to edit (move delete) nodes.

Hit K to toggle detail (display of data to show points and nodes on the screen) .

Hit L to globally change the Code, P1, or P2 for a all entries of a code.

Hit M to go to the DOS prompt so that you can issue DOS COMMANDS. For example, hit J and open a small text editing program such as the EDIT program supplied with DOS 5 to edit a text or plot control file.

Hit X to return to the DOS prompt.

After selecting A, to edit an entry, enter the code of the entry to be selected or A to select from entries of all codes.

Responses to the ENTER CRITERIA prompt are made by typing the appropriate reply, then hitting the ENTER key. Many other responses do not require use of the ENTER key. Watch prompts and information messages carefully.

## WINDOW

### Keyboard version:

Hit the **B** key to set a new window to obtain more detail on the screen in a smaller area. As increments of position are limited to one pixel on the screen at time of editing, windowing is essential for precise editing. After entering **B** a + sign will appear on the screen near the lower left corner of the edit window. The + sign is the cursor. It is moved from the initial position using the arrow keys on the numeric keypad and/or the Home, End, PgUp and PgDn keys for diagonal movements. The + cursor can be moved outside the window to increase the view, even outside the data base limits (not true in mouse-mode).

### Fast or slow cursor movement:

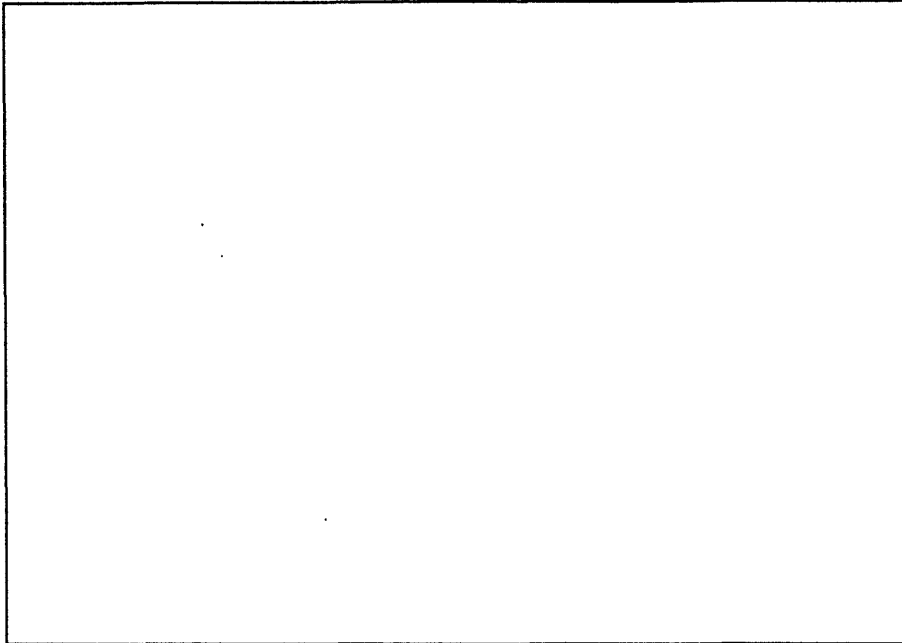
The **F** (fast) or **S** (slow) key changes the speed of movement of the cursor between the fast and slow modes. Cursor movement starts using 10 pixel increments. In fast mode the cursor moves in 20 pixel increments; in slow mode, one pixel at a time. Precise adjustments always should be made in slow mode. The screen will appear as below, with the prompt ENTER LOWER LEFT CORNER positioned below the lower left corner of the screen window.

### Setting a window

#### ENTER LOWER LEFT CORNER

Move the cursor to the lower left corner of the desired window using the appropriate keys on the numeric keypad. Hit the ENTER key to establish the position of the lower left corner of the window. This will bring a second cursor + to the upper right corner of screen window and the prompt:  
ENTER UPPER RIGHT CORNER

Move the second cursor to the upper right corner of the desired window using the appropriate keys on the numeric keypad. When properly positioned, hit the ENTER key to establish the position of the upper right corner of the window. Data in the data base inside the window will then be plotted on the screen. The proportions of the window box will change to correspond to the window specified. Windowing should be continued until the desired degree of zoom has been obtained for the editing task at hand. The screen will request entry of **CRITERIA**. Repeat windowing until the desired field is shown. For large data bases each windowing step takes time. On a complete geologic map of a 7 1/2 minute quadrangle, plotting to the screen using GSMEDIT took about 3 1/2 minutes running on an XT from the hard disk. The + cursors can be moved outside the boundary of the screen window; this allows increasing the size of the windowed area, albeit blindly. The cursors are not plotted on the screen when outside the screen display window but their positions are in effect. The box outlining the screen window will be blanked out at the location crossed by the cursor as it leaves view. In this way windowing can be used to slightly increase the size of the windowed area. The **E** restart function generally offers the best way to increase the size of a window by returning the display to that specified in the plot control file.



FUNCTIONS  
A=SELECT  
B=WINDOW  
C=ZOOMOUT  
D=ORIG.WINDOW  
E=REFRESH  
F=EDT DST  
G=TOG.GRD  
H=CH.MODE  
I=MEASURE  
J=EDT NOD  
K=TOG.DET  
M=DOS COM  
X=EXIT

X ZM. 1  
Y ZM. 1

ENTER DESIRED FUNCTION

USE HOT KEYS TO SELECT

#### Windowing, Mouse-mode:

Hit the **B** key. As increments of position are limited to one pixel on the screen at time of editing, windowing is essential for precise editing. After entering **B** the distinctive mouse cursor will appear on the screen. The prompt will request ENTER LOWER LEFT CORNER. Move the cursor by moving the mouse, select the position by clicking the Left Mouse Button (LMB). Similarly, at the ENTER UPPER RIGHT CORNER prompt move to the desired corner and click the LMB. In mouse-mode a window cannot be set outside the limits of the current view (and not outside the limits set in the plot control file.

After windowing, proceed with editing, and at the ENTER CRITERIA prompt enter the code of the entry to be edited or **RETURN** to select from entries of all codes. Entry of **D** selects the code of the previous selection (code 1 at the opening of GSMEDIT). After entry of the criteria (code) a cursor + will appear near the lower left corner of the screen window and the prompt will then call for the identification of the entry to be edited:

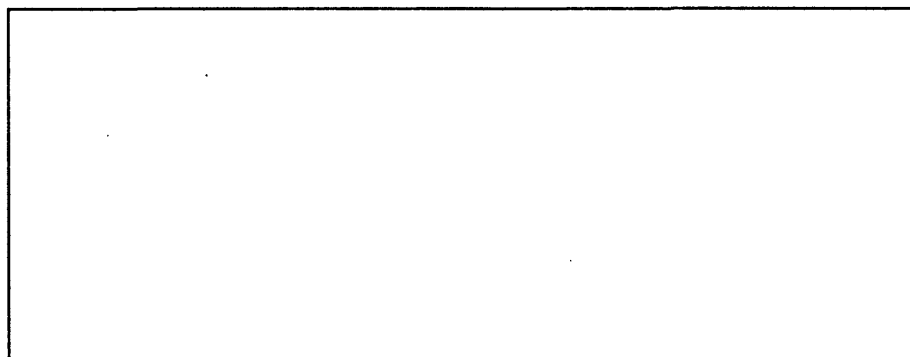
If you change your mind after specifying a function, at most prompts that specify IDENTIFY, when using the mouse, click the right mouse key, then hit the Esc key and you will escape back to the previous point in the program that requires choice of a function. If using the arrow keys to move the cursor, hit the Esc key to back up to the same point in the program.

#### The K Toggle.

After windowing, hit **K** to toggle the point and node display ON. This display (new to Version 9) will assist most of the edit functions. Nodes that serve as the end points of two or more lines codes 1-99) will be displayed as small white circles; nodes that belong to a single line (dangling nodes) will be displayed as small bright yellow squares. Points will be displayed as very small circles drawn in the color of the line for all codes. Nodes are not formed at the ends of splined lines, codes 600-699 or polygons, codes 400-499, 800-899.

## IDENTIFY ENTRY

Move the cursor to a position on the entry, hit the ENTER key. The selected entry will be highlighted on the screen using high intensity white on a color monitor, and the screen will change to show the EDIT FUNCTIONS and display the CODE, P1, and P2 for the selected entry. The line at the bottom of the screen will display a prompt requesting confirmation, as below:



### FUNCTIONS

A=MOVE PT  
B=BREAK  
C=CHANGE  
D=DELETE  
E=REVERSE  
F=ADD PTS  
X=EXIT

X ZM. 111  
Y ZM. 92

ENT 4  
CODE 1  
P1 0  
P2 0  
PTS= 6

ENTER C (ACCEPT) or SPACE (REJECT)

Hit the C key if the correct entry was selected, the space bar if the correct entry was not selected. The process of selection will be repeated until a stroke of the C key confirms that the correct entry was chosen, or until the program determines that no entry lies within the edit distance of the point selected. When an entry is selected and confirmed the prompt will change:

Enter the edit function desired.

### Edit functions after selecting an entry to edit

Hit A=MOVE PT if you wish to move a point from one position to another, e.g. to make the ends of two lines meet. By using this option single points can be moved new positions. To move several points of multi-point entries, move points one at a time.

Hit B=BREAK to break a line into two segments.

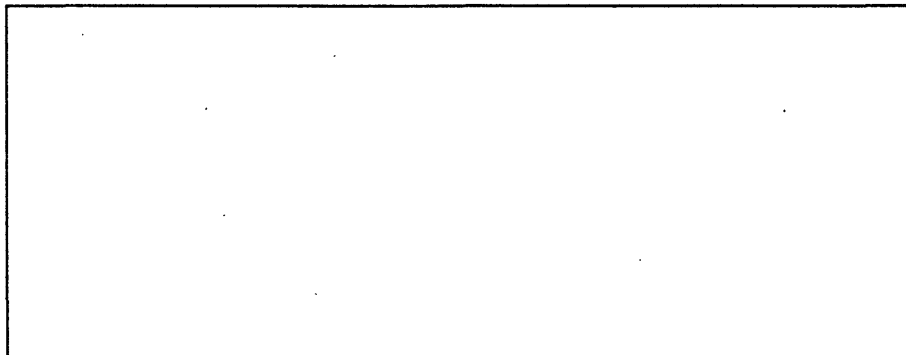
Hit C=CHANGE to change code, P1, or P2 for an entry.

Hit D=DELETE to delete a point or an entry.

Hit E=REVERSE to change the direction of points in a line. Although the direction of digitizing is not important to most undecorated lines, the direction of a line (from the first point to the last) determines the side of the line that is decorated, e.g. with triangles for a thrust fault. The R function can only be used with lines, codes 1-99 and 600-699.



The sequence of edit operations depends on the function selected. If A (move a point) is selected the next screen allows a particular point on a multi-point entry to be selected so that its position can be changed. The point is selected by moving the cursor to the point:



#### FUNCTIONS

A=MOVE PT  
B=BREAK  
C=CHANGE  
D=DELETE  
E=REVERSE  
F=ADD PTS  
X=EXIT

X ZM. 111  
Y ZM. 92

IDENTIFY POINT

ENT 4  
CODE 1  
P1 0  
P2 0  
PTS= 6

Move the cursor to the point desired (if you hit the ENTER key (LMB, mouse version) the cursor will jump to the previous cursor position). The A (advance a point) and B (backup a point) keys can be used to move the cursor from one point to another on a multi-point entry. The prompt will be:  
A=ADV.TO NEXT PT, B=BACK TO PREV.PT, C=CONFIRM PT, E=EXIT

When the proper point has been identified  
hit the C key. The next prompt will call for entry of the revised position for the selected point:  
ENTER NEW POINT

Move the cursor to the new position for the point, and when properly positioned hit the ENTER key (LMB mouse version). If correct, confirm by hitting the C key, or if wrong, hit the Space bar to reject the change, then repeat the process. Coordinates for new position will be substituted for the original coordinates in the data base. Operation of the other edit functions is accomplished in much the same way as that described above.

Care in picking the point used to identify an entry pays off in many ways; you are sure to identify the entry you want, and if you are breaking a line or identifying a point to be deleted the cursor will reappear at the point used to identify the entry. If you chose the correct point, the second job is done with a simple stroke of the ENTER key (with a click of the LMB, mouse version). If you move the last point of a line farther from the node than the snap distance, a new node will be created.

#### Editing nodes

Start by hitting the K toggle so that nodes and points are displayed on the screen, then hit J to start the edit sequence. The prompt is:  
IDENTIFY NODE

Move the cursor to the node and identify it by clicking the left mouse button or hitting the ENTER key (arrow mode). The node selected will be displayed in white with the prompt:

ENTER C (ACCEPT) OR SPACE (REJECT)

If you accept the node by hitting C, the screen will offer functions as below:

**A=MOVE**

**B=DELETE**

**X=EXITE**

A move the node will bring the prompt:

ENTER NEW POINT

Enter the new location for the node. The last point of lines attached to the node will be changed to the node's new coordinates.

Deleting nodes is desirable if editing has left nodes not attached to a line. Deleting single nodes is best done by choosing the B option from the screen above; automatic deletion of all unattached nodes can be done by generating an ASCII file from the data base, then rebuilding the three data base files. The program does not permit the deletion of a node that represents the end of a line, codes 1-99.

## Editing polygons

Only the exterior polygons for entries codes 400-499 are drawn on the screen. Editing other than changing parameters of complex polygons with both exterior and interior polygons should be avoided. It's easy to make mistakes. If you insist, it is possible to separate an exterior and interior polygon into separate polygons and edit the outlines. To do this change the code of the entry from a 400-499 code to a 1-99 code. The edit program will then show the exterior and interior polygons connected by straight line segments. Editing can be done if the first and last points of external and interior polygons are not moved or deleted. To separate an exterior polygon from an internal polygon change the code to that of a line, then break the line segment connecting the two polygons near its center. Then delete the remaining segments of the line that formerly connected the two polygons by deleting the break points from each entry.

## Digitizing using GSMEDIT, INPUT MODE

Digitizing can be done using the screen display of GSMEDIT to reference entries in a data base and keys on the numeric keypad or a mouse to move the cursor to appropriate positions. GSMEDIT is best used for digitizing entries with few points, such as labels and text where placement relative to previously digitized entries is important, not the precise position on hard copy. Single points with known coordinates can be digitized using keyboard rather than graphics mode, and entering the numerical coordinates of the point from the keyboard.

Enter GSMEDIT as if you were about to edit the contents of the data base.

Set a window to make best use of the screen for the area in which you wish to work.

Move to the input (digitize) mode by entering **H** at the prompt requesting entry of criteria (not a choice on the message at the side of the screen).

The screen will prompt for entry of code, P1, and P2 in turn. Enter these from the keyboard, not the numeric keypad.

The screen prompt will ask if you wish to use keyboard entry or graphic input mode:  
GRAPHICAL OR KEYBOARD(SINGLE POINT) INPUT(k/G):

If you choose **K** the prompt will ask for entry of the coordinates of the point. If you choose **G** the screen will prompt then prompt ENTER POINTS.

In graphics mode move the cursor to appropriate positions using keys on the numeric keypad of the computer just as in the edit mode, or by moving the mouse.

### Keyboard operation:

Use the **0** key to digitize a point and leave the entry open, the **1** key to digitize a point and close the entry, the **2** key to digitize a point and close a polygon, the **3** key to close a polygon and leave the entry open. Uses of these keys on the keyboard parallels those of the GSMAP program using a digitizer. Digitizing can be done using data bases with either geodetic or Cartesian coordinates. Resist the temptation to use the ENTER key for digitizing points. Its use may produce unwanted effects.

### Mouse-mode:

Move the cursor by moving the mouse. Digitize points by clicking the left mouse key until you reach the last point, then use the right mouse key for this point, then hit the 1, 2, or 3 keys on the keyboard to instruct the computer as to the kind of point last entered. The 1 key records the point and ends the entry, the 3 records the point and closes an external polygon without ending the entry, the 2 closes the final polygon and ends the entry.

## ADDITIONS TO AN EXISTING TEXT FILE

A special feature in GSMEDIT (and GSMAP) that can be used when digitizing entries with 500-599 and 700-799 codes permits addition of single lines of text to the text file. If a 500-599 or 700-799 code is defined in the plot control file (and consequently a text file exists), if you wish to digitize a single-line text entry not defined in the text file, enter the code at the ENTER CODE prompt, enter P1=0, enter P2 at the size you wish. a prompt will request:

ENTER TEXT:

Use the keyboard to type the desired text (displayed on the bottom line of the screen, don't type a line too long to fit the available space), hit the ENTER key to enter the text, then the space bar; then digitize the point or points as desired. GSMEDIT can't find #0 in the text file, so it lets you add a line to the existing file, and tells you its number so that you can use the text again without retyping. Caution! If there are blank lines at the end of the text file, you will get an "INPUT PAST END" error message and wind up back at the DOS prompt.

## DRAFT MODE

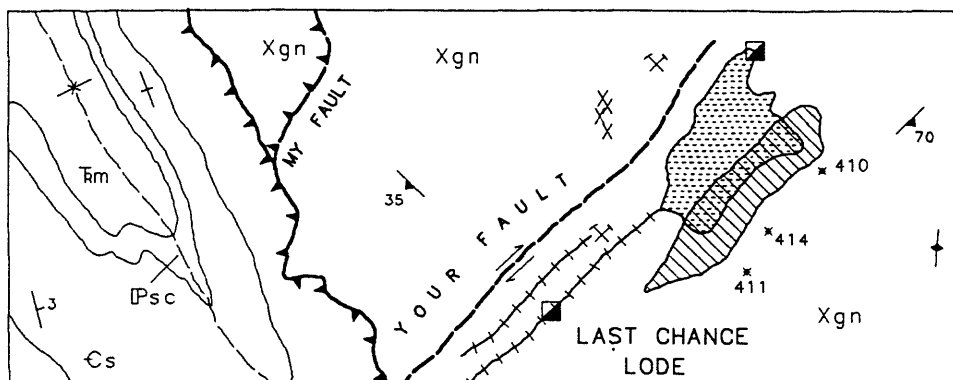
If Draft mode Y is specified in the plot control file, the ends of lines and the starting=ending point of polygons will be marked with a small circle. Use of the draft mode facilitates editing of lines, especially in moving end points, and permits easy identification of the presence or absence break points in extended lines. Entry numbers are not plotted by the GSMEDIT program, unlike GSMAP.

## CHAPTER 3

### TUTORIAL

#### ABOUT GSMAP Version 9.0

The \*documentation for the GSMAP SYSTEM 9 provides a systematic description of a series of programs. The present text is a supplement dealing with the GSMAP program providing ideas developed during use of the program and answering some of the questions commonly asked by new users at training sessions. It also deals with some of the changes introduced into version 9.0. This text is written for the darkling user who has \*scanned the documentation, but not yet studied it. We hope it will also assist users of previous versions of these programs to come up to speed in Version 8.0. Data bases generated by Versions 3, 4, 5, and 6 of GSDRAW and 3-8 of GSMAP are completely compatible with GSMAP Version 9. Modification of pre-6 projection files and plot control files will generally be required. That's the price of avoiding \*obsolescence. Terms marked with an asterisk are defined in the glossary. In case of emergency look them up. If you don't need this tutorial, start a bonfire with the paper you're now reading. Outside, please. Regardless, we welcome you to GSMAP Version 9.0.



GEOLOGIC MAP OF THE EXERCISE AREA

Figure 12. Drawing for GSMAP exercises.

## \*JUMPSTART | GSMAP CARTESIAN COORDINATES

The following section would be called a tutorial except that under that name you would expect a scholarly exposition and read only the first half page; it provides a guide through one small project, one that provides familiarity with many GSMAP procedures and with similar events in the other programs of this set. The exercise assumes availability of necessary hardware and software and emphasizes data input, after all that's where you will start with your first real project.

We suggest that you retrieve your copy of the \*documentation for GSMAP Version 9.0, the first part of this report, from its present position supporting the short leg of the drafting table, so that it is available for reference and so that you will become familiar with the inside of the report.

First. Find a \*guru and ask \*him to make sure that the computer, digitizer, printer, and plotter are working, properly configured, and cabled, that the hardware is ready. If no \*guru can be found, read the \*documentation. Don't try to fight hardware and software problems at the same time.

Second. Turn on the plotter, the digitizer, the printer, and the computer. See manufacturer's instructions.

Third. Boot up the computer. Do this after the plotter has been turned on. There's something about GSMAP that likes this sequence, or maybe it's the idiosyncrasies of certain plotters; at any rate this sequence always works, at least most of the time. If the plotter was turned on after the computer was booted up the initialization may be different than desired. This seems to depend on the kind of plotter.

Next. Make a copy of some files on a working disk, or be sure that they are in a suitable subdirectory on a hard disk. In case of emergency or dire poverty please be aware that a minimum working set for GSMAP will fit on a 360 Kbyte disk and can be operated from a two-floppy disk PC with monochrome graphics and math co-processor chip, but also on the Gigabyte drive on your new 100 Megahertz 586 (Pentium 5, sorry about that slip). In truth, and we won't lie to you all the time, effective use of these programs requires at least an XT with hard disk and EGA color graphics.

GSMAP.EXE Executable GSMAP program

CONFIG9.SCR Screen configuration file

CONFIG9.DIG Digitizer configuration file

CONFIG9.PLT Plotter configuration file

CONFIG9.SYM Symbol definition file

0.FNT Font definition file #0 (default font)

DRAW.PLT Plot control file (Cartesian coordinates) for the tutorial exercise

Now. Tape Figure 22 securely to the digitizer board. Put the exercise disk in the active drive, or use the subdirectory where you stashed the GSMAP files as the default directory, or best consult the \*guru about the use of the \*environmental variable GSFILes to properly set up a system. Look for the DOS prompt; if you are using a disk make sure that the exercise disk is in the default drive. Consult a \*guru if there's any question about which drive is A:, B:, .....

GSMAP is a board game. Some gambits can be played without a digitizer, but that's best done after you reach the status of a \*guru. The procedures described in this section let you create a digital version of Figure 22. This exercise reviews most of the rules for the board. After completing this task you will be ready for some additional rules required in using GSMAP with geodetic coordinates.

Some input for GSMAP comes from the computer keyboard, some from the keypad of the digitizer. During digitizing sessions the keypad is used to send instructions to the computer so you don't have to run back and forth between digitizer and computer. First, the digitizer sends instructions to the computer to prepare it to accept data. Then the digitizer generates X,Y coordinates (for a point) that tell the computer where the cursor is on the board with a resolution of 1/1000 inch, and sends these coordinate pairs to the computer for storage.

To create a line, a string of X,Y coordinates (pairs) is sent to the computer for storage. During plotting, the computer will tell the plotter what to do, how to connect the points that have been digitized, and how to draw an illustration according to the rules of GSMAP.

NOW it's your turn to use GSMAP. \*Enter GSMAP from the keyboard (see glossary for the definition of "enter", if there's any question about this. The computer screen will soon exhibit the \*disclaimer message. The disclaimer screen will be displayed briefly, then go away after it has set you straight. During the "disclaimer" wait the program is loading symbols, so don't think that the time is completely wasted. Yes, all responsibility is yours. The Main Menu screen is displayed next.

G S M A P  
VERSION 9.0

- 1 - START A NEW DATA BASE
- 2 - OPEN AN EXISTING DATA BASE
- 3 - DIGITIZE NEW ENTRIES
- 4 - DELETE ENTRIES
- 5 - RECOVER ENTRIES
- 6 - CHANGE PARAMETERS FOR ENTRIES
- 7 - LIST CONTENTS OF DATA BASE
- 8 - PLOT DATABASE ON SCREEN/PLOTTER/DISK
- 9 - ISSUE DOS COMMANDS AND STAY IN GSMAP
- 10 - EXIT TO DOS

ENTER CHOICE BY NUMBER: \_

At the top it reminds you that you are using GSMAP, and on the left there are a series of options. The name of the current data base and the map title will be added after you open a data base, so there is a space on the upper right for this added display.

On the lower right of the ENTER CHOICE BY NUMBER: prompt a blinking cursor requests an entry: Such prompts let the computer tell you about the next step in operating GSMAP.

Each session in GSMAP must begin either by starting a new data base, or by opening an existing data base. Now, let's start a new data base. Start a data base by \*entering 1 from the keyboard, hit the 1 key, then the ENTER key. A listing will appear on screen of the data bases in the default area; the program checks the list of \*.NDX files, so the data bases are listed that way, e.g. TEST.NDX. The free space on the default drive is listed, and then at the bottom of the screen, the prompt will be:  
ENTER DATA BASE NAME: ?

For this exercise enter SPECIAL. You can use any name with 8 characters or less; please follow these directions so we don't get confused. This name will become the name for the data base files, so when you're on your own observe the rules of DOS for file names. Don't enter a file name with an extension. GSMAP will

supply extensions for the three files that it uses for a data base. After you enter **SPECIAL** the screen will prompt:

IS THIS A GEODETIC OR CARTESIAN DATA BASE?(G/C):

Enter C to choose a Cartesian coordinate system, and the next prompt will request:  
ENTER TITLE OF MAP:

For this exercise Enter **EXERCISE**. You can use any name with 8 characters or less. The **TITLE** is simply another aid you can use to remind yourself of what the data base contains. After this entry the screen will clear, and a new prompt will be displayed:

OPTIONAL METHODS FOR SPECIFYING DATA BASE CORNERS  
FROM DIGITIZER

1 - ALL FOUR CORNERS FROM DIGITIZER  
FROM KEYBOARD

- 2 - SPECIFY UPPER RIGHT CORNER (X,Y)
- 3 - SPECIFY LOWER LEFT(X,Y), UPPER RIGHT(X,Y)
- 4 - ALL FOUR CORNERS

ENTER OPTION:

Choose Option 1: Enter 1 from the keyboard. The screen will clear, then display a list of files in the active area with extension .PLT and the prompt:

ENTER PLOT CONTROL FILENAME (SPECIAL.PLT):?

In Version 9.0 of GSMAP the plot control file is used to control plotting to the screen as you digitize, as well as to make plots on a plotter after completing a data base. This makes a full screen display possible, including text and symbols. Enter **DRAW.PLT** (the name of the plot file for this exercise). After this entry the plot file will scroll down the screen. GMAP is checking to see that this file is correctly put together. If it isn't the program will stop the display and provide an error message prompting you to fix it. But the **DRAW.PLT** file is correct unless you changed it, so the prompt will change to:

ENTER EDIT DISTANCE (0.1):

The edit distance (with its default value of 0.1 inch displayed in the square brackets) is required when editing contents of a data base. For now, just hit the Enter key to accept the default value.

After this entry the screen will display another prompt, the first of a new series. Follow directions provided by these prompts. The next entries in response to screen prompts will be made using the keys on the cursor of the digitizer. For the first \*entry of 0 to synchronize digitizer input, the cursor can be at any position within the active area of the digitizer board (the little red light on the cursor must be on). When "entering" the corners carefully position the cross hair of the cursor over the corner, (use the angle brackets on figure 22 as corners), press the 0 key on the keypad to \*enter the corner, move the cursor to the next corner as specified by the screen prompt, and similarly \*enter the other corners in turn, as specified by the prompts shown below:

ENTER 0(ZERO)ON CURSOR KEYPAD TO SYNCHRONIZE DIGITIZER INPUT

ENTER UPPER LEFT CORNER ON DIGITIZER (use the 0 key)

ENTER LOWER LEFT CORNER ON DIGITIZER (use the 0 key)

ENTER LOWER RIGHT CORNER OF DIGITIZER (use the 0 key)

ENTER UPPER RIGHT CORNER ON DIGITIZER (use the 0 key)

These four entries from the keypad define the data base corners and index the drawing to the digitizer board. After entry of the fourth corner the screen will revert to the Main Menu screen, with the prompt,  
ENTER CHOICE BY NUMBER:

The Main Menu screen will now show the name of the current data base **SPECIAL**, the word **CARTESIAN** to remind you that the data base uses Cartesian coordinates, and the map title **EXERCISE**. By starting data base **SPECIAL** from the digitizer, you opened this data base and indexed the hard copy to the digitizer table for this session. This data base will remain open and indexed until you open another one, Option



2, start another, Option 1, or exit from the program. The name of the current data base, its coordinate system and title are displayed near the upper right corner of the Main Menu screen.

Now let's start a digitizing session by entering 3. The screen will clear, and display the following prompt:

ENTER PLOT CONTROL FILENAME (SPECIAL.PLT): ?

Enter **DRAW.PLT** .. remember ? that's the name of the plot control file for this exercise. The screen will change to the Input screen, as shown below. The functions of the keys on the digitizer's keypad are indicated under the words KEY DEF.

INPUT

KEY DEF.

A=END FLD  
B=WINDOW  
C=CH. MODE  
D=DUPLIC  
E=RESTART  
F=EDIT DS  
O=POINT  
1=END  
2=END POL  
3=END INT  
999=EXIT

ENTER CODE

Make sure that the copy on the digitizer board doesn't move during digitizing. If it should, immediately stop digitizing, then open the data base, (Option 2) and index the drawing properly to the digitizer board by selecting Option 3 from the Main Menu.

You are now ready to digitize. But first read ahead a bit. it will then be time to digitize some lines, and other kinds of graphical entities. A number of kinds of graphical elements are needed to draw Figure 11. Take a careful look at this figure to identify the kinds of graphical elements.

- #1. Lines: seven different kinds; the border, contacts, dashed line fault, dashed-line fold axis, solid-line thrust fault, dashed-line thrust, dikes.
- #2: Symbols that have an orientation that means something: six different kinds; inclined dip and strike, vertical dip and strike, inclined foliation, vertical foliation, syncline axis symbol, right lateral fault arrows.
- #3. Symbols that are always oriented the same way, but that you might like to draw in different sizes: three different kinds; pick and hammer, mine shaft, prospect.
- #4. Areas that are filled with a pattern: two different kinds; a stippled area, a line patterned area.
- #5. Lettering: several sorts; rock unit labels, and the name of a mine.
- #6. A smoothed line: used here for the synclinal axis.
- #7. The title of the map and the name of the faults.

Special use is made of capabilities of GSMAP to plot two elements of this illustration:

- #101. Symbols with posted numbers, representing geochemical values in this exercise.

Numbers 1-7 for graphical elements in the list above correspond to the code group numbers that

GSMAP uses for these kinds of elements. #101 represents a special capability.

GSMAP uses code groups as follows:

- 1-99. Lines.
- 100-199. Symbols and posted numbers/letters read from a row/column table.
- 200-299. Symbols that must be individually rotated into proper position.
- 300-399. Symbols where whole groups have the same orientation.
- 400-499. Areas that need filling with a pattern.
- 500-599. Alphanumeric entries.
- 600-699 Lines smoothed by the computer.
- 700-799 Special alphanumeric entries, such as letters following a line.

#### Lines, codes 1-99

All lines are digitized as if they were solid lines. Dotted lines, dashed lines, heavy lines, fine lines, decorated lines, thrust faults (shown by lines decorated at intervals with triangles) are drawn by choosing these patterns and decorations in the plot control file, and by selecting a pen with a fine point or one with a broad point. Don't digitize each dash separately. Pretend that the dashes are connected. The plotter will dash the line for you (it's a lot less work for you, and the plotter does a better job).

When planning digitizing for Figure 12, there seemed to be seven different kinds of lines based on pattern (solid, dashed), and "decoration". These seven kinds of lines require seven different codes. We used the following: code 1 for contacts, code 50 for the box around the diagram, code 5 for the approximately located (dashed) strike slip fault; code 603 for the synclinal axis; code 7 for the solid line thrust; code 8 for the dashed line thrust; code 11 for the dikes.

The lines around the stippled area and around the area filled with parallel lines will be digitized using one of the 400-499 "filled area" polygon codes; code 400 for the stippled area, code 401 for the area filled with the pattern of parallel lines. The short leader to the Psc label near the lower left corner of the diagram will be drawn as a leader when digitizing the Psc label. It doesn't count as a kind of line, according to the logic of GSMAP.

The computer asks for three pieces of information about each graphical entity that will be digitized. The first is for a code, the second is for P1 (parameter 1), the third is for P2 (parameter 2). There is a systematic description of these three in the \*documentation. The use of code, P1, and P2 is different for different kinds of graphical entities. Specifying a code always requires entry of a string of three numbers; if there are less than three numbers in the code, the code string is ended using the A key, Parameter 1 requires 6 numbers or a shorter string ended by the A key, or the A key alone (enters 0); Parameter 2 likewise requires 6 numbers, a shorter string ended by A, or the A key alone (enters 0).

For lines, the code can be any number 1-99. P1 and P2 are almost always 0. These two parameters are included for lines because it's easier to use three parameters for all codes than to remember different numbers of parameters for different codes. In Versions 7 and 8 of GSMAP, P2 can be used to set sizes for symbols used to decorate lines.

When entering the code, P1, and P2, for lines from the keypad, use the numbered keys, then use the A key (end a string) to complete entry of each of the three. Numbers are entered in sequence from left to right, followed by the A if there are less than three digits.

Now go back to the keypad and enter 50A. A tone will sound (Concert C) indicating completion of the entry of CODE(1); next enter A; a tone will sound (concert F) indicating completion of entry of P1; then enter A to set P2; Concert A (440 Hertz) will sound, indicating that digitizing of points can begin. These three tones rising in pitch provide auditory proof that the computer is ready for the next entry. The lowest line on the screen will show the values that have been entered, and as digitizing proceeds will show the entry number

for the line digitized, the code, the value of  $P1 = P1$ ,  $P2 = P2$ , and the number of points digitized.

### The E key

If you make a mistake at any time between starting entry of the code and closing the string of points defining the line, press the E key and you will ESCAPE back to the point of starting entry of the code. The entries made between these times will not be recorded in the data base.

### Digitizing lines (codes 1-99) The 0 (zero) key and the 1 (one) key.

You have entered the code, P1 and P2, keystrokes 10A, A, and A. Five lines on the right side of the screen should now show:

```
ENTRY  1  
CODE=50  
P1    0  
P2    0  
# PTS 0
```

It's time to put points on the board. When digitizing data points, the keys on the keypad of the cursor have specific functions. Striking the 0 (zero) key sends a pair of coordinates (X,Y) from the digitizer to the computer. This key is generally used for points on a line from the first to the next-to-last. The last point is digitized with the 1 (one) key. Let's digitize the top line of the rectangular box first. Take a careful look at the box before starting. There are seven places where lines intersect the top side; there are none on the right, six intersections on the bottom, and three on the left. We suggest digitizing each of the line segments separately (intersection to intersection).

The computer is ready for input of data points. Move the cursor to the upper left corner of the box, position the cross hair precisely at this point, press the 0 key (a tone will sound); then move the cursor along the line (move to the right) to the first intersection with a line (the fold axis) press the 1 key (a tone will sound), this ends the entry of this line segment. The prompt will say "ENTER CODE". Enter 1A, then A and A as you did before to prepare to digitize the next segment. Start at the point you digitized to end the first segment using the ) key, move to the next intersection to the right and digitize this point with the 1 key. Repeat this process to digitize segments between all intersections along the line until you reach the corner. Eight segments are required. Listen for the tones that tell you about the next step in the digitizing process. End the last segment At the upper right corner of the box. After each segment is digitized the line segment is drawn on the screen. Success!

### The D key

The computer is ready for entry of code, P1, and P2 for the next line. At this point, if you choose (or if you let us choose for you), you can use the D ("duplicate") key to set the code, P1 and P2 to the values of the preceding entry with a single keystroke. Try the D key. A rapid sequence of three tones will sound. The final tone (Concert A) indicates that the computer is ready to record data points. Use of the D key saves lots of key strokes.

Digitize the line forming the right side of the box. At the upper right corner press the 0 key, move to the lower right corner, press the 1 key. The high pitched tone will indicate that you've finished digitizing this line. The newly digitized line will be drawn on the screen.

Use the D key to enter code, P1, and P2 (50,0,0), and digitize the lower line of the box. Start at the lower right corner using the 0 key, move left along the lower line to the first intersection and press the 1 key. Repeat the process for each of the line segments. The 14th will bring you to the lower left corner of the box. Again use the D key to enter code, P1, and P2. Digitize each line segment on the left vertical line as before. Start digitizing data points with the 0 key, move to the next intersection and end the segment with the 1 key. End the last segment at the upper left corner. This segment completes the outline of the box. We used 20 segments to complete the outline. We'll talk about why a bit later. In general, map outlines and through-going lines should be digitized first.

The stroke of the 1 key that ends a line tells the computer to record of the data points for the entry in the data base, to draw the line on the screen, and to sound the high pitched tone to tell you that the computer is ready for entry of code, P1, and P2 for another line. A mighty stroke. All with one blow. Now you can see the box on the screen. If the lines look broken, remember that the resolution of the screen isn't low compared with the 1/1000 inch resolution of the digitizer and plotter. When the line moves from one set of pixels to another it seems to jump abruptly. It won't jump this way when drawn on the plotter, if you digitized carefully.

Let's digitize the solid-line thrust next. As it is a different kind of line we need to use a different code. Let's enter code 7 (enter by pressing 7A on the keypad), P1=0 (press A on the keypad), P2=0 (press the A key) and listen as the three tones rising in pitch are sounded by the computer. The last (concert A) indicates that data points can be entered.

Start with the 0 (zero) key at the point where the thrust line ends on the north (top) side of the rectangular box, then precisely follow the line with the cross hair of the cursor, and press the 0 key at frequent intervals. Pretend that this is the kid's game of "connect-the-dots" and put in enough points that straight line segments connecting the points will produce a close approximation of the curved line. Watch for the intersection of the solid line thrust with the dashed line thrust and use the 1 key at this intersection to end the segment. Hit the D key to enter CODE P1 and P2, continue to digitize the solid line thrust and put points in with the 0 (zero) key until you have put in the next to last point. When you reach the end of the line, press the 1 (one) key. The high pitched tone will sound. The line just digitized will be drawn on the screen and added to the data base. Note that the both the thrust teeth and the line are shown on the screen, and if you are using a color EGA or VGA monitor that the teeth and line are different colors. These specifications are included in the plot control file DRAW.PLT.

Now the system should be ready for you to digitize another line. Digitize one of the contacts in the upper left part of the map. Use code=1, P1=0, P2=0. You remember the key strokes, don't you? 1,A then A, then A, with the three ascending tones telling you the computer was listening to your instructions. Start digitizing data points on the line with the 0 key, digitize points with the 0 key, watch for intersections, and end each segment with the 1 key. Disregard the leader line, it's not a line to reckon with.

Follow the digitizing procedure you used for the previous lines, and digitize another of the contact lines. Remember to start at one end using the 0 key, follow the line entering points with the 0 key, and finish each segment using the 1 key. Again, the closing of the string of points defining the segment will be signaled by a high-pitched tone. Use of the D key will save keystrokes and time.

Finish digitizing the rest of the contacts; D key to set code=1, P1=0, and P2=0. Use the 0 key and the key to digitize data points as described above. You're already an expert! \*Guru status comes later.

Next enter code=5, P1=0, P2=0, keystrokes 4A,A, A, and digitize the strike slip fault; you know which keys to use. Although it's dashed on the screen, you may not be able to see the breaks in the line because of the resolution of the screen.

Next, enter code=11, P1=0, P2=0, keystrokes 11A, A, A, and digitize a dike, following the solid line with a series of 0's and ending each line with the 1 key. The pattern of the line (solid) and the "decoration" (cross lines) will be specified during plotting. Digitize the dike just as if it as a thin solid line, and

forget about the decorations (you will see them on the screen because they are specified in the plot file). Digitize the second dike, the **D** key will set code=11, P1=0, and P2=0.

Now digitize the dashed-line thrust fault. The thrust you've already digitized (code 7) was mapped with a solid line; a different code must be used so that the plotter will draw a dashed line. With a decoration (the triangular teeth) that plots only on one side of the line, the direction of digitizing is important. Please digitize the dashed thrust, keeping the teeth on the right side of the line (with respect to the direction of digitizing). Start at the top. Once again ignore the dashes and the teeth, digitize as you did the other lines, but use code 9. Enter code, P1, and P2 using keystrokes **8A, A, A**, and digitize with the **0**, and **1** keys.

Remember that dashes and teeth are characteristics specified in the plot control file. After digitizing, the screen will show lines, patterns and decorations as specified in this file.

Let's review the digitizing of a line.

The **0** zero key is used from the start until the next-to-last point, each time it is pressed, an X,Y coordinate pair is sent to the computer. Striking the **1** one key sends a pair of coordinates from the digitizer to the computer, and also tells the computer that a string of points has been completed, and resets the program to the point of entry of the code.

Codes 600-699 are splined lines.

The function of this code group is like that of group 1-99 except that the computer will smooth the line plotted by computing up to as many as 5 times the number of points digitized using a cubic equation, spacing these points equally along the line, then connecting all of these points with straight line segments, rather than playing connect-the-points-digitized like codes 1-99. A splined line will pass through all digitized points; the algorithm is house-broken.

Now digitize the synclinal axis. Enter code=602, P1=0, P2=0 keystrokes (**602**), **A, A**, (NOT **602A,A, A**. Because 602 has three digits you don't need to finish entry of the CODE with the A key), and digitize the line. The pattern along this line will be set by the plotter later, so digitize it with a series of 0's, a 0 at the intersection with the other thrust, and a 1 to end the line. Remember to digitize it as if it were a solid line (not one dash at a time). Make sure that the line extends from the top of the box to the bottom line.

Don't digitize the leader in the southwest part of the map as a line. This will be digitized as a part of the label -- a bit later.

Polygons, codes 400-499

The 2 (two) key

The **2** key. A stroke of the **2** key records two points. Use it to complete outlines of closed polygons like the line that encloses the stippled area. One recorded point will be the point where the cursor is positioned; the second will be the first point of the line. Pressing the **2** key will also close the string of points defining the line (listen for the high-pitched tone). The five points generated by three 0's and one 2 outline a polygon with 4 sides. The last point will have X,Y coordinates identical to the first (the program copies the coordinates of the first point). The outline generated will close to mathematical precision.

Now, digitize the outlines of the two areas filled with patterns. First specify code 400, keystrokes **400** (as there are three numbers, an A is not required to complete entry of the code), then press **A**, then **A**, to enter P1=0 and P2=0. Then choose an identifiable point on the outline of the stippled area, press the **0** key, and follow the outline with a series of 0's, ignore the mine shaft symbol, and at the next-to-last point on the line, a point near the initial point, press the **2** key. As you now know, this key will record a point and close the line by repeating the first point; it will also return the computer to the stage for entry of the code for another line.

Enter **401, A, A**, to specify code=401, P1= 0, P2= 0, and digitize the outline of the area

filled with the parallel line pattern. Use key strokes like you did for the preceding polygon.

#### Individually rotatable symbols, specific codes 200-299 group

Now take a close look at the symbols that are used on the map. Certain symbols (e.g. strike & dip) must not only be plotted in the right place, but also must be drawn at a specific angle. Each of the individually rotatable symbols has its own code, P1 is used to specify the angle of rotation (clockwise) from the 0° position for that symbol; P2 is used for the angle that is to be posted for symbols that require posting.

The strike and dip symbol near the lower left corner of the map is entered as Code=201, P1 =345, P2 = 3. Dip & strike symbols for inclined beds (a dip between 0 and 90 degrees) are code 201. The 0° rotation for this symbol is for a N strike and an E dip. If the dip angle is 90°, use code 221; the proper symbol will be drawn, and no angle will be posted. If the dip is 0° use code 231; the proper symbol will be drawn, and no angle will be posted. Foliation symbols for foliation dipping between 0 and 90 degrees are specified by using code 202. P1 specifies the rotation of the symbol. Rotation of 0° gives a north strike, an east dip; P2 is used for the dip angle to be posted. If the dip of the foliation is 90 degrees, use code 222. If the angle of rotation is specified as P2, rotatable symbols are digitized using the 1 key.

Let's run through the entries required for some of the individually rotatable symbols on the map. First, let's digitize the strike and dip symbol near the left corner of the map. The key strokes needed to enter code, P1, and P2, are the following: 201, 345A, 3A; during entry the now-familiar CFA tones will be heard. Then move the cursor to the precise position of the center of the symbol, and use the 1 (one) key to digitize the point. The high-pitched tone sounded will indicate that the computer is ready for entry of the code for the next entity.

There is another way to digitize individually rotatable symbols if they are accurately plotted on the hard copy. Let's go through this alternative method which makes the computer compute the angle or rotation.

Select the vertical foliation symbol at the lower right side of the map, enter code 222, P1 of 0, and P2 of 90 (keystrokes 222, A, 90A). Move the cursor to the center of the symbol on the map and digitize the point with the 0 key, then move the cursor along the strike line and digitize a point at its upper end using the 1 key. The computer will calculate the bearing, enter it as P1, enter it in the data base and plot the symbol on the screen.

Next digitize the inclined foliation symbol on the right side of the map, (code=202, P1= 0, P2=70), (keystrokes 202, A, 70A), then, with the cursor in proper position, use the 0 key to digitize the center point, then the 1 key to digitize a point at the upper right end of the strike line.

With this two-point digitizing method the first point is digitized at the center of the symbol, the second (which sets the rotation) at the end of the strike line, moving in such a way as to keep the posted value (dip) on the right in the direction of movement.

Finish digitizing the other symbols of these types. The paired arrows indicating the direction of offset on the strike slip fault require code =210; let the computer figure the required rotation (P1; use the A key to enter 0 for P1 and for P2, digitize the first point on the fault trace and the second at a little distance from the first, also on the fault trace. The symbol specifying the synclinal axis requires code=205, a value for P 1 calculated to rotate the symbol from a N-S direction, you figure the required rotation, or let the computer do it, and P2=0. Digitize with the 1 key if you calculate the angle of rotation, or with two strokes (0 and 1) if the computer is to do it. Check the screen display to see if the angles of rotation for all the symbols and if the dip angles have been entered correctly.

#### More symbols, codes 300-399

The 300-399 code group is used for symbols that are not individually rotatable but which must be

drawn to a specified size. These symbols can be rotated in groups defined by code number. The code is entered as any other code would be, P1 is used for the symbol number, P2 is used to specify size (in units of 1/1000 inch). The prospect symbol is symbol number 12, the mine symbol, number 13, the mine shaft symbol, number 14. 300-99 code group symbols can either be digitized individually (using the 1 key), or in groups using the 0 key, if a number of symbols with the same code, symbol number, and symbol size are needed; the final symbol in the group is digitized with the 1 key. Let us suggest the key strokes that might be used to digitize the symbols on Figure 12; let's use code 300 for all of them. Enter **300, 14A 100A**; move the cursor to bring the cross hair to precisely the center of the lower mine shaft symbol, press the 1 key. The high-pitched tone will sound, and a point will appear on the screen indicating the position digitized. Next, press the D key, the three tones (CFA) will sound and the screen will show code = 300, P1 = 14, P2 = 100. Move the cursor to the other mine shaft symbol, press the 1 key. The high-pitched tone will sound, the screen will show the point, and the computer will be ready for entry of a code.

Digitize the prospect symbols next. Use the key strokes **300, 12A, 80A** to enter code = 300, P1 = 12, P2 = 80 (a size of 80 (80/1000 inch), then move the cursor to the center of one of the prospect symbols, press the 0 key; move to the other prospect symbols in turn, digitize all but the last by pressing the 0 key. Digitize the last using the 1 key (to end the entry).

Next digitize the mine symbols, using code = 300, P1 = 13 and P2 = 80. Digitize individually using the 1 key, then the D key to set code, P1, and P2, or as a group using the 0 key except for the last symbol; use the 1 key.

The principal difference in digitizing symbols as a group or individually, is in editing. Symbols digitized individually are deleted individually. Symbols digitized as a group can be deleted as a group, or can be deleted individually using the edit mode (more about this later).

#### Alphanumeric entries, codes 500-599

Codes 500-599 draw information from an ASCII file using an index number as P1. Check the listing below carefully, and some resemblance will be seen to the lettering on Figure 12.

|                                        |                                           |
|----------------------------------------|-------------------------------------------|
| (DRAW.RU)                              | The information in the listing to the     |
|                                        | left under the name of the file (DRAW.RU) |
| 1,"am",                                | is from the ASCII file needed             |
| "EOT"                                  | when Figure 12 is plotted. It contains    |
| 2,"&sc",                               | information you will need to complete     |
| "EOT"                                  | the digitizing of this figure. This file  |
| 3,"s",                                 | is included on the release disk you       |
| "EOT"                                  | copied to make the exercise disk.         |
| 4,"Xgn",                               |                                           |
| "EOT"                                  |                                           |
| 5,"Ti",                                |                                           |
| "EOT"                                  |                                           |
| 6,"LAST CHANCE",                       |                                           |
| " LOOE",                               |                                           |
| "EOT"                                  |                                           |
| 11,"MY FAULT",                         |                                           |
| "EOT"                                  |                                           |
| 12,"YOUR FAULT",                       |                                           |
| "EOT"                                  |                                           |
| 10,"GEOLOGIC MAP OF THE EXERCISE AREA" |                                           |
| "EOT"                                  |                                           |

Let's look at the line above starting with "4", and the line immediately below this line, to see what this

strange list means. The number 4 will be used as P1 for an entry code = 555 (could be any code 500-599); the letters that will be plotted are the ones between the quotation marks Xgn; these letters make up one of the rock unit labels on the figure. The "EOT" (always upper case letters, please, stands for END OF TEXT and is used to end the lines that will be plotted for an entry (code 500-599) when P1=4.

Now examine the line starting with 6, and at the two lines below it. If P1=6 is entered, these two lines will be plotted (see figure 12 for how it plots). The "following "EOT" line ends this two line text entry. They will be digitized and plotted together!

Let's digitize the alphanumeric data, and then discuss the punctuation of the ASCII file and some of the characters that plot differently than they appear in the file. Please use code 555 for all of the rock unit labels. P1 will be entered to match the number of the entry in the file DRAW.RU needed on the figure. P2 specifies the height of the letters needed (in units of 1/1000 inch).

Digitizing for labels without leaders is done by moving the cursor to the precise position where the lower left corner of the block of text should be plotted; in the case of the Xgn, the lower left corner of the X. Let's run through the key strokes needed to place one of these Xgn labels; code = 555, P1 = 2, P2 = 80; in sequence keystrokes 555, 2A, 80A; then digitize the entry by moving the cursor to the lower left corner of the X and pressing the 1 key. Use code = 501 for the entry of the LAST CHANCE LODE block of text. The key strokes would be 501, 6A, 80A, then the position of the text is digitized by pressing the 1 key after the cursor had been precisely positioned at the lower left corner of the L in LAST; both lines of text will be positioned from this single point. Separate entry of the word "LODE" would require a different ASCII file.

Specification of certain infrequently used characters in the ASCII file causes plotting of some of the geologic characters not found on any keyboard. Some of these are used on Figure 12.

| ASCII FILE | Symbol plotted              |
|------------|-----------------------------|
| \          | Cambrian C                  |
| &          | Pennsylvanian P             |
| @          | Triassic TR                 |
| {          | o superscript degree symbol |
| }          | " superscript second symbol |

You can't use the quotation mark to specify seconds in the ASCII file because it is a delimiter in BASIC, the language used in writing this program. Now you can read DRAW.RU and decipher its arcane symbols.

Please resume digitizing, use code = 555, P1 to match the number in the DRAW.RU file for the entry you want to digitize, and P2 = 80 (letters 80/1000" high), and digitize the remaining rock unit labels (except the Psc label that has a leader). Use the 1 key.

Digitizing a label with a leader is done slightly differently. As before specify code, P1, P2 (for this label keystrokes 555, 2, 80 to set code = 555, P1 = 2, and P2 = 80).

The label Psc is digitized by moving the cursor to the lower left corner of the P, and then pressing the 0; then the leader is digitized by moving the cursor to one end of the leader, pressing the 0 key, moving the cursor to the other end of the leader and pressing the 1 key to end both the leader and the entry. A line will be drawn between the last two points. The leader is a part of the digitized label, as it should be. Multiple leaders can be digitized (see \*documentation). If a label with a leader is deleted, the leader is also deleted.

Proper entries using codes 500-599 always have odd numbers of points. If entries using these codes have even numbers of points expect big trouble. Lines will plot that you didn't digitize and don't expect. Think about this; the first point places the block of text, the next two define a leader, the following two another leader, and so on. If you don't complete a leader the computer will helpfully do it for you, but the point it selects to complete the leader is up to it, unless you provide it. So there.



## Codes 100-199

The 100-199 code group is used for symbols that are to be posted with values drawn from a table. Examples would include sample localities for which chemical values might be of interest. An ASCII table in proper format would look like this one, named DRAW.SAM, and used for this exercise.

|                       |                                                   |
|-----------------------|---------------------------------------------------|
| 410, 50, 10, 100, 200 | Each row has sample number, Cu, Mo, Pb, Zn values |
| 411, 15, 2, 20, 200   |                                                   |
| 414, 30, 50, 150, 200 |                                                   |
| 416, 70, 10, 300, 500 |                                                   |

Symbols with posting of 410, 411, and 414 to the right of the symbol should be digitized in this exercise using code 101. The locality identification number is entered as P1. Enter P2=0 for each of these points. The function of P2 is discussed in the documentation; it acts as an "angle" to place the posting into different positions. The keystrokes for code, P1 and P2 for the uppermost sample locality are **101, 410A, A** to enter code=101, P1=410, P2=0. Then digitize the center point of the symbol using the 1 key. The other points (posted 411 and 414) can be digitized similarly, but let's use the two-point digitizing for this code group introduced in GSMAP Version 8. Enter Code=101, P1=411, P2=0. Move to the symbol indicating the locality point and press the 1 key, then move to the lower left corner of the "411" block and press the 1 key. This ends the entry. The posted values for a 2-point entry with P2=0 will be plotted to the right of the second point (not the symbol point). The use of this alternate posting position allows great flexibility in design of an illustration. Now finish digitizing entries in code 101 with the symbol and alternate posting position for this last entry.

## Codes 700-799

The 700-799 code group was added to Version 8.0 to facilitate entry of text. It draws text from an ASCII file just as the 500's do, but the rules of digitizing are a bit different. No leaders, no multi-line entries. In this exercise CODE 701 is used for the map title and for the names of the faults. For the title enter CODE=701, P1=10, P2=100, keystrokes **701 ,10A, 80A**. Then digitize a single point located at the left end of the block of text (just like a 500 code). Then enter CODE=701, P1=11, P2=60 and digitize the lower left corner of the "MY FAULT" block of text with the 0 key, then digitize a second point at the base of the "F" in FAULT" with the 1 key. This completes the entry. The first point of a TWO point entry in the 700-799 code group sets the lower left corner of the block of text, the second establishes the slope of the line of text. The line of text will appear on the screen after the 1 key is pressed. Now digitize the "YOUR FAULT" line of text. Set CODE=701, P1=12, P2=60. Digitize a string of points along the base of the line of text. Sketching a smooth line along the base of the text with a pencil might help. Digitize this line, starting with the 0 key at the lower left corner, then a series of points on it with the 0 key, ending with the 1 key at the right end of the line of text. If more than two points are used to digitize an entry using one of the 700-799 codes, the characters in the entry will be spaced equally along the digitized line. If more than 5 points are digitized, the line will be splined (smoothed) so that the characters are rotated to fit a curved trace.

The digitizing of Figure 12 is now complete! Check the screen display against the original copy to make sure, and to admire your handiwork and the screen display of Version 8.

## ENDING A DIGITIZING SESSION

Enter a CODE of **999** to return to the Main Menu. The instructions on the right side of the screen have the line **999=EXIT**. This means exit to the Main Menu.

Let's chat about some of the details of the procedures that you so obediently followed. Although lines can be digitized in any sequence, using any code 1-99, through-going lines generally should be digitized first. One option of the utility program GSMUTIL can be used to precisely snap ends of lines together; the controlling points are the ends of the lines in the order digitized, so regard points at ends of lines as control points, and especially those at the beginning of the data base.

We digitized the box first. the solid-line thrust next. A single code could have been used for the box and for contacts, but use of two codes kept each code to a single function. That's good practice. We used code 501 for text entries and 555 for rock unit labels, these have different functions even though they are graphically the same. Good general practice confines each code to a single function.

Codes in the 600-699 group are well used for lines like the fold axis on this drawing. After all, it's hard to locate the precise trace of an axial surface or crest line of a fold in the field.

Codes in the 100-199 group were used to associate symbols and posted values, rather than separate symbols and numbers.

Codes in the 200-299 group specify specific symbols, each individually rotatable.

Codes in the 300-399 group are chosen for other symbols, sized individually.

Codes in the 400-499 group were used so that areas could be patterned.

Codes in the 500-599 were used for rock unit labels and the mine name because these codes can generate leaders and plot multi-line text entries. Two codes were used to separate the different functions of the text entries. This way it's easy to plot the mine name in red, or adjust the size of the rock unit labels as a group. The capabilities of the 700-799 codes to set slants for words and space letters along a linear trace were exploited for the names of the faults. The different font used in the plot will be specified for these at plot time.

Now let's plot the results.

Load a piece of paper in the plotter. Put a fine black pen in position 1, a fine red pen in position 2, a fine blue pen in position 3, and a coarse black pen in position 5. These positions correspond to choices made when creating the plot file (DRAW.PLT) which we will use. Enter 8 (from the keyboard of the computer to choose Option 8 from the Main Menu.

After entering 9 the screen will clear, and you will be asked by a prompt:  
SCREEN,PLOTTER,DISK? (S,P,D,PR):

You've seen the plot on the screen when digitizing, so please enter **P** to go to the plotter. The prompt will ask for the name of the plot control file. Enter **DRAW.PLT**.

The size of the map=illustration will be provided, and you will be prompted:  
DO YOU WANT TO CONTINUE?(Y/N): ? The default answer is Y, that's the default answer so hit the ENTER key.

You will be reminded that the plotter must be ready. You did turn the plotter on, didn't you...? and load it with paper and pens, didn't you ...! This warning message will be displayed on the screen.  
**PLOTTER SHOULD BE TURNED ON AND PAPER LOADED!!!!!!**  
**HIT ANY KEY WHEN READY**

Hit the space bar to proceed. Prompts will appear that require entries from you to begin plotting. These two prompts will require entries from the keyboard. The first prompt provides opportunity to plot corner braces to show the locations of the corners specified in the plot file (in this case also the corners of the data base).  
**DO YOU WANT TO DRAW CORNER BRACES? (Y/N):** Enter Y.

The second prompt provides opportunity to draw tick marks on a regular grid (with spacing that you specify in inches for a Cartesian data base) inside the drawing, a capability that may be useful in plots used for editing or merging of data bases.

DO YOU WANT INTERNAL GRID TICK MARKS (Y/N):

Enter N.

The default answer (provided by hitting the ENTER KEY) to these two prompts is N. Entry of the answer to the last of these prompts (generate tick marks) tells the plotter that it should go to work.

Watch the plotter, or drink a cup of coffee. But don't go too far; it won't take long to plot this exercise. When the plot is finished operation will return to the Main Menu screen.

Now try out some of the options on the Main Menu to see how they work. (see description in \*documentation), or just follow the prompts on screen. DO NOT ask for printouts on the printer unless the Printer is On. You are free to do as you like, far be it from us to dictate, but do so knowing that requests for printouts without a printer ready to go may cause the system to take time out, and may require rebooting the computer. YOU WERE WARNED !

The print below is a copy of the file DRAW.PLT with annotations on the right that are not a part of the plot control file, yes it's the plot file used in the tutorial exercise, yes there are codes in the file that weren't used in the exercise. But next time!

|                                                    | ANNOTATIONS                                              |
|----------------------------------------------------|----------------------------------------------------------|
| Y                                                  | YES, USE DATA BASE CORNERS                               |
| 1.0,1.0                                            | XSCALE=1,YSCALE=1                                        |
| 0,0                                                | XOFFSET=0",YOFFSET=0"                                    |
| N                                                  | DRAFT MODE NO                                            |
| Y                                                  | YES ROTATE                                               |
| 12,2                                               | SPEED=12, FORCE=2                                        |
| 1,1,0,0, "FINE BLACK LINES-CONTACTS"               | CODE=1,PEN=1,LINE TYPE=0,SYMBOL=0                        |
| 2,1,3,0, "CONTACT-APPROXIMATELY LOCATED"           | CODE=2,PEN=1,LINE TYPE=3,SYMBOL=0                        |
| 3,1,1,0, "CONTACT-CONCEALED"                       | CODE=3,PEN=1,LINE TYPE=1,SYMBOL=0                        |
| 4,5,0,0, "FAULT"                                   | CODE=4,PEN=5,LINE TYPE=0,SYMBOL=0                        |
| 5,5,3,0, "FAULT-APPROXIMATELY LOCATED"             | CODE=5,PEN=5,LINE TYPE=3,SYMBOL=0                        |
| 6,5,7,0, "FAULT-CONCEALED"                         | CODE=6,PEN=5,LINE TYPE=7,SYMBOL=0                        |
| 7,5,0,102, "THRUST_TEETH ON RIGHT"                 | CODE=7,PEN=5,LINE TYPE=0,SYMBOL=102                      |
| 0.2,1                                              | SPACING=0.2",ALTERNATE PEN=1                             |
| 8,5,3,102, "THRUST APPROX. LOCATED TEETH ON RIGHT" | CODE=8,PEN=5,LINE TYPE=3,SYMBOL=102                      |
| 0.18,1                                             | SPACING=0.18",ALTERNATE PEN=1                            |
| 9,5,7,102, "CONCEALED THRUST FAULT TEETH ON RIGHT" | CODE=9,PEN=5,LINE TYPE=7,SYMBOL=102                      |
| 0.18,1                                             | SPACING=0.18",ALTERNATE PEN=1                            |
| 601,1,0,0, "FOLD AXIS"                             | CODE=601,PEN=1,LINE TYPE=0,SYMBOL=0                      |
| 602,4,9,0, "FOLD AXIS APPROXIMATELY LOCATED"       | CODE=602,PEN=4,LINE TYPE=9,SYMBOL=0                      |
| 603,4,7,0, "FOLD AXIS CONCEALED"                   | CODE=603,PEN=4,LINE TYPE=7,SYMBOL=0                      |
| 11,2,0,101, "DIKE DECORATED RR TRACK"              | CODE=11,PEN=2,LINE TYPE=0,SYMBOL=101                     |
| 0.1,1                                              | SPACING=0.1",ALTERNATE PEN=2                             |
| 201,1,0,0, "INCLINED BEDDING"                      | CODE=201,PEN=1,LINE TYPE=0,SYMBOL=0                      |
| 221,1,0,0, "VERTICAL BEDDING"                      | CODE=221,PEN=1,LINE TYPE=0,SYMBOL=0                      |
| 202,1,0,0, "INCLINED FOLIATION"                    | CODE=202,PEN=1,LINE TYPE=0,SYMBOL=0                      |
| 222,1,0,0, "VERTICAL FOLIATION"                    | CODE=222,PEN=1,LINE TYPE=0,SYMBOL=0                      |
| 205,1,0,0, " SYNCLINE SYMBOL"                      | CODE=205,PEN=1,LINE TYPE=0,SYMBOL=0                      |
| 210,1,0,0, "ARROWS RT LATERAL SYMBOL"              | CODE=210,PEN=1,LINE TYPE=0,SYMBOL=0                      |
| 555,1,0,0, "ROCK UNIT LABELS"                      | CODE=555,PEN=1,LINE TYPE=0,SYMBOL=0                      |
| DRAW.RU,0                                          | TEXT FILE=DRAW.RU, FONT=#0                               |
| 501,1,0,0, "NAMES ON MAP"                          | CODE=501,PEN=1,LINE TYPE=0,SYMBOL=0                      |
| DRAW.RU,0                                          | TEXT FILE=DRAW.RU, FONT=#0                               |
| 400,2,1,0, "STIPPLE SOLID OUTLINE"                 | CODE=400,PEN=2,LINE TYPE=1,SYMBOL=0                      |
| 4,.03,0,3,0                                        | FILL TYPE=4,SPACING=0.03",ANGLE=0,ALT PEN=3,FILL LT=0    |
| 401,3,0,0, "DIAGONAL PATTERN SOLID OUTLINE"        | CODE=401,PEN=3,LINE TYPE=0,SYMBOL=0                      |
| 4,.050,-45,3,0                                     | FILL TYPE=4,SPACING=0.50,ANGLE=-45,FILL PEN=3, FILL LT=0 |
| 300,1,0,0, "MINE PROSPECT SYMBOLS"                 | CODE=300,PEN=1,LINE TYPE=0,SYMBOL=0                      |
| N                                                  | NO, DON'T RANDOMIZE ANGLE                                |
| 101,1,39,40, "GEOCHEMISTRY"                        | CODE=101,PEN=1,SYMBOL=39,SIZE=40                         |
| DRAW.SAM,0                                         | DATA FILE=DRAW.SAM, FONT=#0                              |
| 4,0                                                | FOUR DATA COLUMNS IN FILE, PLOT #0=P1                    |
| 0.04,0.06                                          | WIDTH=0.04", HEIGHT=0.06" POSTED CHARACTERS              |
| 701,2,0,0, "NAMES OF FEATURES"                     | CODE=701,PEN=2,LINE TYPE=0,SYMBOL=0                      |
| DRAW.RU,0                                          | TEXT FILE=DRAW.RU, FONT=#0                               |
| 50,1,0,0, "MAP OUTLINE"                            | CODE=50,PEN=1,LINE TYPE=0,SYMBOL=0                       |
| 0,0,0,0, "END OF PLOT FILE"                        | 0,0,0,0, END OF PLOT FILE                                |

This file provides a good start for your next project using a Cartesian data base. Feel free to copy and modify, in fact, you may never need to start a plot file from scratch. Plagiarize, cheerfully, with our blessings.

## Windows and editing

### Windows

Still using GSMAP? Invoke option 3 (Digitize) again. Follow the prompts as before when you were digitizing. Now let's try setting a "window". Hit the B key with the cursor somewhere within the active area of the digitizer. To set the size of the window to be displayed on the screen, move the cursor to the lower left corner of the box, press the 0 key, move to the intersection of the solid line thrust and the dotted line thrust and again press the 0 key. The area inside the rectangle with diagonal defined by the points set with the 0 key will be enlarged and displayed. Repeat the windowing process, use the corners of the box, and we'll go on.

### The EDIT MODE

You were promised a discussion of the "EDIT DISTANCE" and would we lie to you? Not this time. GSMAP Version 9.0 incorporates some edit functions into Option 3. The edit distance is set to help identify entries using the digitizer. When you use the digitizer to identify an entry, entries farther from the cursor position than the maximum pointing distance won't be identified. 0.1 (meaning 0.1 inch) seems a good distance to specify (it's also the default distance), so hit the ENTER key to select this default distance.

Let's do some editing. System ready for input of CODE in the INPUT MODE (digitizing)? Look like the screen below?

INPUT

KEY DEF

A=END FLD  
B=WINDOW  
C=CH.MODE  
D=DUPLIC  
E=RESTART  
0=POINT  
1=END  
2=END POL  
3=END INT  
999=EXIT

ENTER CODE

Instead of entering a code, hit the C key=CH MODE to change from INPUT to EDIT. The screen will change, and the line at the bottom of the screen will prompt:

ENTER CRITERIA

The screen will appear as below:

```
EDIT  
  
SELECTION  
---BY---  
CODE  
  
---OR---  
  
A  
  
999=EXIT
```

#### ENTER CRITERIA:

The "Criteria" to be entered here is either the **code** of the entry you want to edit or **A** meaning that you will want entries of all codes examined. With a large data base the upcoming search for an entry may be greatly speeded up by entering the **CODE** of the entry desired. This way the computer won't have to rummage through the entire contents of the data base. This search may take time.

To play this game, enter **300** as the "criteria" = code of the entry to be selected. The instruction line at the bottom of the screen will change to:  
**IDENTIFY ENTRY**

Now move the cursor to one of the prospect symbols, (digitized as a group, remember?), press the **1** key. The screen will change: The bottom line furnishes instructions, the right side provides information about the uses of keys and the entry selected, as shown below. The points of this entry will be highlighted on the screen.

EDIT  
FUNCTIONS

A=MOVE PT  
B=BREAK  
C=CHANGE  
D=DELETE  
E=EXIT

Entry 13  
CODE= 300  
P1 12  
P2 80

ENTER FUNCTION:

Select MOVE POINT by hitting the A key on the keypad. The instruction line at the bottom of the screen will change to:

IDENTIFY POINT

With the cursor on a particular one of the prospect symbols hit the 1 key to select this symbol. The screen will change to show new uses for keys and a new instruction, as below:

EDIT  
FUNCTIONS

A=ADV PT  
B=BCK PT  
C=CONFIRM  
E=EXIT

Entry 13  
P1 20  
P2 80

ENTER FUNCTION

The A and B keys can be used to move from one point of the entry to the next. The position of the keypad doesn't matter for this. Try it. The cursor on screen will shift from one point to the next. To select the point to be moved hit the C=CONFIRM key. The cursor will disappear, the points of the entry will be shown as a line, and the instruction line will change to:

ENTER NEW POINT

Select the new point. Move the cursor to it, then hit the 1 key. The point will be added to the screen. Now hit the C key to CONFIRM that the point is correctly placed. The screen will change as shown below:

EDIT  
FUNCTIONS

A=MOVE PT  
B=BREAK  
C=CHANGE  
D=DELETE  
E=EXIT

Entry 13  
CODE= 300  
P1 12  
P2 80

ENTER FUNCTION:

The point has been changed to the new location. Now hit the E key. This will return the screen to the first edit screen:

EDIT  
  
SELECTION  
---BY---  
CODE  
  
---OR---  
  
A  
  
999=EXIT

ENTER CRITERIA:

To return to the INPUT (digitize) screen hit the C=CH.MODE key, and you're ready to digitize more data, or by entering 999=EXIT return to the Main Menu. A bit involved ?? yes, but this interactive edit mode is a powerful tool. Follow instructions carefully. Pay close attention to the prompts that provide the uses of the keys. Interactive editing does change the data base, so provide appropriate backup!



## JUMPSTART II, GSMAP; GEODETIC COORDINATES

Digitizing using geodetic coordinates is the same as digitizing in Cartesian coordinates. If you digitized Figure 12 and understand its constructs and the uses of the different code groups, you already know all about digitizing entries into data bases that use geodetic coordinates. How's that for a JUMPSTART! Most of this section is concerned with the procedures that are different for geodetic coordinates. Let's compare some of the characteristics of GSMAP for geodetic and Cartesian coordinates.

### GEODETIC

### CARTESIAN

#### Data Base Corners

|                                                                                    |                                                                                      |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Specified by latitude/longitude<br>from keyboard when starting a new<br>data base; | Entered from keyboard <u>or</u> from the<br>digitizer when starting a new data base. |
|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|

#### Scale of Data Base

|                                                 |                                                                                                                                          |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| There is no inherent scale in<br>the data base. | Data is recorded in X,Y coordinates,<br>generally in inches corresponding to<br>the scale of the drawing used to start the<br>data base. |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|

#### Plot scale

|                                                                                                                                     |                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The plot scale is specified<br>as numbers, the denominator<br>of the scale fraction.<br>e.g. 1:24000 scale is<br>specified as 24000 | The plot scale is specified by a factor<br>related to the size of the original<br>drawing, the numerator of the<br>scale fraction. eg. a 1:2 plot (half size)<br>is specified as a scale of 0.5 |
|-------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### Plot areas

|                                                                                                            |                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Corners are specified<br>by latitude/longitude<br>coordinates, <u>or</u> data base<br>corners may be used. | Corners of plot area are those of the<br>data base, or may be specified in the plot<br>control file. using the X,Y system of the<br>drawing. |
|------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|

|                                                               |                                                                                                                                          |
|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Sizes of symbols and characters<br>Independent of plot scale. | 100-199, 300-399, 500-599, 700-799 codes<br>Size automatically changed as a function of<br>the scale in X, independent of<br>scale in Y. |
|---------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|

When using Cartesian coordinates, scaling of the X,Y values sent to the computer by the digitizer is controlled by the coordinates of the data base corners. The X scale is set by the distance between the lower left corner and the lower right corner, the Y scale by the distance between the upper left corner and the lower left corner. Digitizing into a single data base can be done from drawings at different scales so long as the geometry of the data base corners is identical.

When using a geodetic data base, points are recorded in latitude and longitude coordinates. Use of map projection routines computed to "double precision" means that digitizing can be done from maps using most of the common map projections, data from different maps using different projections and at different scales can be directly combined, and maps can be drawn on any of the supported projections, see p. 146 for list, at any scale within the limitations of legibility and plotter size.

When working with geodetic coordinates, GSMAP requires a projection parameter file, (also called a projection file). This is an ASCII file that tells the computer which projection to use and provides data to the computer needed for calculations.

## MAP PROJECTIONS

GSMAP has forced many users to reacquaint themselves with map projections, a topic covered to some degree in dimly remembered classes. From a practical standpoint, digitizing from a base map and plotting to make precise overlays for the maps usually aren't very complicated. One reference by John Snyder is especially important; USGS Professional Paper 1395 is a classic. It contains answers to the questions you should have. Information on the map projection is almost always printed near the lower left corner of the map. On the AMS 1 x 2 degree maps the projection is given under the bar scale. Look for magic words like these: Lambert Conformal Conic, Polyconic, Transverse Mercator, Albers Equal Area (or such) on map borders. This subject is covered in the reference section of the documentation.

GSMAP requires a projection file with parameters matching the map to be used for digitizing and the same or different file for plotting. As GSMAP stores data in latitude and longitude coordinates, the geometry of a particular map projection is not built into the data, as would be the case if the map were digitized using a Cartesian coordinate system.

We'll assume that you are game for a small exercise using GSMAP. In it we will use the UTM projection. The required projection file is named MAP.PRJ and is included on the GSMAP disk.

If you didn't have it, you could write it in a few minutes using an ASCII word processing program or EDLIN, a program you never use that probably came along with the DOS operating system purchased with your computer. The projection file required by GSMAP Version 9.0 for this exercise is printed below with comments to show what each line means. Projection files are a way of life in GSMAP if geodetic coordinates are to be used and provide it with much of its power. A print of the file is supplied below.

| MAP.PRJ   | Comments (not a part of the file)                                       |
|-----------|-------------------------------------------------------------------------|
| 1         | 1 designates Universal Transverse Mercator.                             |
| 6378.2064 | Equatorial radius in km, Clarke 1866.                                   |
| 6356.5838 | Polar radius in km. Clarke 1866.                                        |
| 105,0,0,W | Longitude, Principal Meridian of UTM Zone for the map in this exercise. |
| 0.9996    | Scale factor used for the UTM projection.                               |

### GSMAP geodetic exercise

Figure 12 has been set up so that the angled brackets outside the corners of the rectangle can be used as the corners for a geodetic exercise, as well as for the Cartesian exercise suggested earlier.

The coordinates below will enable opening of a data base and digitizing into that data base using the MAP.PRJ projection file. These coordinates are in the proper format for data entry: first Latitude, then Longitude, in Degrees, Minutes, Seconds, each followed by a single character providing the compass direction. In the conterminous 48 states, latitudes are always North = N, longitudes are always West = W.

Northwest corner 38,15,0,N,106,0,0,W  
Southwest corner 38,0,0,N,106,0,0,W  
Southeast corner 38,0,0,N,105,30,0,W  
Northeast corner 38,15,0,N,105,30,0,W

You must first open a data base, either by starting one using Option 1, or by opening an existing data base, Option 2. Let's start a new data base. Enter 1.

The screen will clear and a series of prompts will appear. The first prompt will be:  
ENTER MAP DATA BASE NAME: MAP

Enter MAP. When you're on your own, pick any name you like. The next prompt will be:  
IS THIS A GEODETIC OR CARTESIAN DATA BASE?(G/C):

Enter G to specify a geodetic data base. The next prompt asks for a title:  
ENTER TITLE:

Enter EXERCISE.

After these three entries have been made, an on-screen prompt as below will be displayed: See \*documentation for details. Choose map type 5 by entering 5.

The next four prompts ask for entry of the latitude, longitude coordinates of the four corners of the map. Use the values provided. Follow the prompts. Their meaning should be clear. The latitude, longitude, and compass direction for each corner is entered in turn in response to the screen prompts; for each corner, latitude first, longitude second; both in degrees, minutes, and seconds (and decimal seconds), then the compass direction, separated by commas, as shown. The coordinates shown in bold type are those for the GSMAP exercise, using Figure 22.

ENTER LAT/LON OF NORTHWEST CORNER  
DD,MM,SS,C,DDD,MM,SS,C:       **38,15,0,N,106,0,0,W**  
ENTER LAT/LON OF SOUTHWEST CORNER  
DD,MM,SS,C,DDD,MM,SS,C:       **38,0,0,N,106,0,0,W**  
ENTER LAT/LON OF SOUTHEAST CORNER  
DD,MM,SS,C,DDD,MM,SS,C:       **38,0,0,N,105,30,0,W**  
ENTER LAT/LON OF NORTHEAST CORNER  
DD,MM,SS,C,DDD,MM,SS,C:       **38,15,0,N,105,30,0,W**

After the coordinates of the NORTHEAST corner are entered, the screen will return to the Main Menu. The name and title of the data base will be displayed. The concept of compass direction is old hat. Just remember that latitudes north of the equator are north=N latitudes, longitudes for 180 degrees west of Greenwich are west=W longitudes. Go east or too far west of Greenwich, longitudes are east=E longitudes. A long time ago a great \*wizard thought that this was a better idea than falling off the edge of a flat earth.

If we remember correctly, your computer screen now displays the Main Menu. Enter 3 to select option 3. Let's go on with a geodetic digitizing session. After entry of 3, the screen will clear and a familiar prompt will appear:  
ENTER PLOT CONTROL FILENAME MAP.PLT

A file named MAP.PLT is included with this release. If it's in the active area of your computer hit the ENTER key. The default file is shown as a part of the prompt. If it's on a disk in another drive include the designation of the drive in your response to the prompt. Enter MAP.PLT. After this the prompt will be:  
ARE THE DATA BASE CORNERS THE REGISTRATION CORNERS?(Y/N):

Enter Y, 'cause it's true, or hit the ENTER key because Y is the default answer. The next prompt asks for the name of the projection file:  
ENTER FILENAME OF PROJECTION PARAMETERS:

with the projection of the hard copy being digitized. We did it for you here. The next set of prompts will be the same as those you saw in the first exercise.

ENTER EDIT DISTANCE(0.1):

Enter .01, hit the ENTER key (the default distance=0.1 inch) is shown inside the square brackets). You know all about \*edit distance. .01 inches is a good value to use most of the time; it does the job, and creates few problems. The next entries are made from the keypad of the digitizer cursor. Use the 0 key, as specified in the prompts. The prompts differ little from those used with Cartesian coordinates:

ENTER 0(ZERO) KEY ON CURSOR KEYPAD TO SYNCHRONIZE DIGITIZER INPUT:

ENTER NORTHWEST CORNER ON DIGITIZER:

ENTER SOUTHWEST CORNER ON DIGITIZER:

ENTER SOUTHEAST CORNER OF DIGITIZER:

ENTER NORTHEAST CORNER ON DIGITIZER:

Synchronization by hitting the 0 key can be done with the cursor at any place in the active area of the digitizer, but must be precisely located when entering the corners. After entering the NE corner you will get a message that tells you the scale and asks if you wish to continue. If both the X and Y scales are about 250,000 enter Y yes from the keyboard of the computer. If not, check the coordinates of the corners by using Option 2. The coordinates of the corners will be shown on the screen. If the coordinates are correct, try Option 3 again, and make sure that you use the angle brackets, (not the corners of the box) when you enter the corners from the digitizer to index the hard copy to the digitizer table.

Digitizing using geodetic coordinates is the same as in Cartesian coordinates. The computer knows the difference; you don't have to. The same code groups are used, their functions are identical, P1, and P2 have the same meanings, the keys on the digitizer have the same uses, and entry of a code of 999 ends a digitizing session.

If you are so inclined, you could digitize Figure 12 again, but isn't once more than enough? Please, for the sake of the last part of this exercise digitize the outlines of the two areas, remember, they're codes 400 and 401. P1 and P2 are 0. Digitize with the 0 key until the next to last point where the 2 key is used to close the polygon. Then, enter 999 from the digitizer to get back to the Main Menu. If you do digitize the figure using GSMAP, plot the results using the plot file MAP.PLT. The only prompts differing from those when Cartesian coordinates are in use require specification of the projection file.

With your new experience with GSMAP using both Cartesian and geodetic coordinates, you're a guru. Our bet is that you can comprehend the \*documentation and follow on-screen prompts. Let's not waste time now with more step-by-step-by-step digitizing and plotting. This GSMAP exercise is over. On to greater things.

### GSMUTIL and GSMPBS

The next part to the geodetic exercise will introduce GSMUTIL and GSMPBS, two support programs for GSMAP. We just couldn't put all of the functions into the GSMAP program that seemed necessary, something about the 640 Kbyte limit imposed by DOS. You digitized the two polygons, codes 400 and 401 into the geodetic data base named MAP. Check to see that the GSMUTIL and GSMPBS programs are available. Consult your \*guru if necessary. Now let's use GSMUTIL. Start GSMUTIL by entering GSMUTIL from the keyboard. After a brief display of the disclaimer screen a menu screen will be displayed with 16 choices on it. Let's start with 8 COMPUTE LENGTHS OF LINES OR AREAS AND PERIMETERS OF POLYGONS. Enter 8. The prompt ENTER INPUT DATA BASE NAME: will be displayed on the screen, respond by entering MAP. The next prompt will be ENTER FILENAME OF PROJECTION PARAMETERS (MAP.PRJ)? Respond by hitting the Enter key to accept the default answer. From the next screen enter 1 to choose square kilometers for as the units for area. Then enter S to get output on the screen. The prompt ENTER CODE(0) TO QUIT asks for entry of the code of the polygon. Enter 400. The screen will tell you that the polygon, code 400, has an area of 13.8 square km, and a perimeter of 17.15 km. Entry of code 401 provides values for this polygon. Leave this option by entering 0. Gone are the days of the analog

code 401 provides values for this polygon. Leave this option by entering 0. Gone are the days of the analog drafting planimeter.

Now let's find out the area of overlap of the two polygons. This requires several steps.

Use Option 1 twice to generate two new data bases, one for each polygon. Enter 1. Follow the prompts. Provide **MAP** as the name for the input data base. Provide the name **400** as the name for the output data base. Select **CODE 400** at the next prompt, then enter 0 to get back to the Menu Screen. Select option 1 again, enter **MAP** as the input data base, select **401** for the output data base name, and code **401** as the code to put into it. Leave **GSMUTIL** by entering 16 from the menu screen.

Start **GSMAP** (enter **GSMAP**), open data base 400 using Option 2., select Option 6 to **CHANGE PARAMETERS FOR ENTRIES** by entering 6. The prompt will ask **Global Change(Y/N/Q)**, enter **Y**. The **CODE TO BE CHANGED** is **400**, next enter **CODE** because we want to change the code of the **CODE 400** entry, **ENTER NEW CODE:** 1. At the next global change prompt enter **Q** to go back to the Main Menu. Open data base 401 using Option 2, select option 6, go through a similar process to change **CODE 401** to code 1. Leave **GSMAP** by selecting Option 10.

We now have two data bases, 400 and 401, each containing the definition of a polygon bearing the code of a line **CODE 1**. Later we'll talk about the need for this change.

Start **GSMUTIL** by entering **GSMUTIL**. Select Option 3 **TRIM ON POLYGONAL BORDERS DEFINED IN A DATA BASE** by entering 3. Select data base **400** as the input data base. Select the output data base name **A**. Enter **401** as the **NAME OF THE DATA BASE CONTAINING BORDER:** The program will run and return operation to the menu screen. Select Option 3, enter 401 as the **INPUT DATA BASE**, **B** as the **OUTPUT DATA BASE**, and **400** as the data base containing the border. Operation will promptly return to the menu screen. This time select Option 7, **MERGE MULTIPLE INPUT DATA SETS INTO AN OUTPUT DATA BASE** by entering 7. The prompt will ask, **WILL THE OUTPUT DATA BASE HAVE GEODETIC OR CARTESIAN COORDINATES (G/C)** enter **G** because we are working with geodetic data bases. Enter the name **C** as the output data base name. Enter **C** as the title for this data base. Enter **Y** to the prompt **GET CORNERS FROM AN EXISTING DATA BASE.** **ENTER MAP** to respond to this prompt. To the **ENTER INPUT DATA BASE NAME:** prompt, enter **A**, when it is repeated enter **B**. As these are the two data bases we wish to merge, when the prompt is repeated, hit the **ENTER** key to go back to the menu screen. Enter 16 to leave **GSMUTIL**. The data base **C** that you created has two lines in it. We need to combine these lines into a closed polygon.

We'll use the **GSMPBS** program to build this polygon. Enter **GSMPBS**. Specify **C** as the name for the input data base, **MAP.PRJ** for the **FILENAME OF PROJECTION PARAMETERS**, and **MAP.PLT** as the **PLOT CONTROL FILE NAME**. Enter **TEST** as the name for the output data base. The screen will change to a plot of the two lines, small red squares will show the two points where ends of the lines meet. The prompt will be **ENTER CODE**, but don't yet. Examine the instructions on the upper right side of the screen. We need a closer view of these lines, so enter **B WINDOW** in response to the prompt instead of a code. The prompt will change to **ENTER LOWER LEFT CORNER**. Move the cursor using the arrow keys on the numeric keypad to a point just below and to the left of the lines. The prompt will ask, **ENTER UPPER RIGHT CORNER** and a second + cursor will appear. Move it with the arrow keys to a position just above and to the right of the lines and hit the **Enter** key.

A greatly enlarged view of the lines, still with the red blocks identifying their ends will appear, together with the prompt **ENTER CODE**. Enter code **400**, and the prompt **IDENTIFY LINES** and a + cursor will be displayed. Use the arrow keys to move the cursor + to the middle of one of the lines on the screen, then hit the 0 key on the keyboard (not the numeric keypad). Then move the cursor to the middle of the second line and hit the 2 key on the keyboard. The lines selected will be redrawn in the bright white color and the prompt will change to **PLEASE CONFIRM (C KEY) OR REJECT (D KEY)**. If there are no extraneous lines, hit the **C** key to accept the polygon. At the **ENTER CODE** prompt that returns, Enter **999** to leave the program.

Data base TEST now contains one polygon that bounds the overlap of the two polygons (codes 400 and 401) in the MAP data base. Use Option 8 to compute the area of this polygon. Our data base gave the answer as 3.69 square km.

Why not use polygon 400 to trim 401 and vice versa ? Read the \*documentation, i.e. you can't. The GSMUTIL program does not permit trimming polygons; use of a polygon to trim other kinds of entries is just fine. If you trimmed polygons and didn't close them you couldn't plot them. Problems are severe and unpredictable if there are internal polygons, especially if the internal polygons are cut apart.

We'd like to add comments based on experience. File preparation and data management provide many headaches. Some traumas can be avoided. It is simpler to copy and modify an existing projection file or plot control file than to prepare one from scratch. If you are used to a particular word processing program, use it for preparing files, but make sure that the files don't have embedded characters (like print commands) or blank lines. Many programs that use particular formats for printing also have an option for exporting an ASCII file. This may work even if the print format won't. Check to see that all punctuation is correct. A misplaced comma can haunt you because a comma is a delimiter in BASIC. If all files for a given project have the same name it's easy to associate the group, whereas truly creative names have a way of being misremembered. Standard extensions are useful. GSMAP always uses .LSF for line-segment files, and .NDX for index files. We suggest .PLT for plot control files, .PRJ for projection files, .RU or .TXT for text files, .DAT for data files for the 100 codes. Notes are easily included at the end of the plot control file and may help refresh your memories of a project after a long interruption for a field season.

## Steps in planning a GSMAP project.

Start by visualizing the final product. What must be shown, how many overlays must be generated to accommodate publication needs for the separate printing negatives needed for screening, color, lines, symbols, lettering, and so on. Digitizing from copy at final map scale will simplify decisions on letter and symbol size, and assist in making a final product that is esthetically pleasing as well as accurate. 1:1 digitizing and plotting usually requires use of a magnifier during digitizing. To us this is a small price to pay to simplify thinking and checking of plots against original materials.

1. Identify the base map projection and scale, and find and mark the latitude/longitude corners that will be used in digitizing. Look carefully for joins between pieces of the base. Check to see if these will be a problem, perhaps even requiring digitizing and plotting in pieces.
2. Work from stable base copy if at all possible. If not, find an environment that won't change during digitizing. Changes in humidity are worse than changes in temperature in causing changes in the scale of paper copy. GSMAP accommodates changes in scale but requires indexing of the data base corners to the digitizer board. GSMAP does not accommodate changes in scale or movement of the hard copy on the digitizer board during a digitizing session. If there has been a change of humidity, close the data base, reattach the hard copy to the board, and open the data base again. Then index the copy on the digitizer board. If precious lines are only on rain-spotted field sheets and the scale is in doubt, index digitizing to a greenline overlay, and adjust small areas of the paper copy to fit - just as you would do if you were making a copy in ink - and move the paper, not the mylar, as needed. Make each area fit, one at a time. There is no "fix" for digitizing done using an improperly registered hard copy.
3. Make up the projection file needed for digitizing and plotting.
4. Now, plan the codes that will be used for digitizing the map. This is a good time to prepare a plot control file. Print a copy for use during digitizing. You will need a record of the codes you used and the purpose for each; this purpose is served by an annotated plot control file. Why not kill two birds with the same file? A printed copy of this file will be useful during digitizing to help keep codes consistent.
5. Make up and print the file containing text entries for the 500-599 and 700-799 code entries that will be used, for the labels for rock units and other text belonging to the map. The printed copy will provide a ready reference during digitizing.
6. For geodetic data bases start a GSMAP geodetic data base with corners that match the corners to be used in digitizing; then digitize a few points on the map; start with points that have known latitude and longitude. Use a code unlikely to be used later, like 399, then print out the latitude and longitude and compare these with the coordinates on the map.
7. Plot the corners and digitized internal reference points using stable film, add geodetic tick marks at suitable intervals, and compare with the base.

### Planning codes for digitizing.

How much standardization of codes is necessary? The ability to edit and change means that you aren't stuck with an early unwise decision. We suggest that what happens between a consenting adult and \*his Personal Computer is between them and their software. Suggestions offered here may be useful to start, but should not be misconstrued as legislating requirements. It seems to us that the consistency of use of codes during digitizing for each project is of primary importance. Enough code groups must be used to provide easy separation of elements during plotting. The suggestions of particular numbers for particular kinds of elements given below are intended more to indicate the kind of elements that require separate codes than to specify a particular code for each. We can't remember them either! If a number of different maps are to be digitized as a series, sticking with one set of codes throughout the set will simplify digitizing and plotting; a slight

modification of a copy of a plot file takes less time than writing one from scratch, and the same one can be used for many projects if the default to the corners of the data base is invoked.

The eight code groups have functionalities that dictate many uses. Planning codes for lines (1-99, and 601-699) should begin with decorated lines that are to be plotted using decorations that are on one side of the line (like thrust faults) because the direction of digitizing is important. Be aware of both the advantages and disadvantages of splining. Check the documentation describing the 600-699 codes.

Code Group 1-99 Lines and decorated lines. Reserve codes 1-15 for geologic lines

| Code | Line type | Decoration | Specification                                                                                    |
|------|-----------|------------|--------------------------------------------------------------------------------------------------|
| 1    | 0         | 0          | Fine solid lines, 00/000 pen<br>Example: contacts                                                |
| 2    | 3         | 0          | Fine dashed lines, 00/000 pen<br>Example: inferred                                               |
| 3    | 1         | 0          | Fine dotted lines, 00/000 pen<br>Example: concealed contacts                                     |
| 4    | 0         | 0          | Heavy solid lines, 0/1 pen<br>Example: faults                                                    |
| 5    | 9         | 0          | Heavy dashed lines, 0/1 pen<br>Example: concealed faults                                         |
| 6    | 7         | 0          | Heavy dotted lines, 0/1 pen                                                                      |
| 7    | 0         | 102/103    | Heavy solid lines with triangular teeth on one side<br>Example: thrust faults 0/1 pen            |
| 8    | 9         | 102/103    | Heavy dashed lines with triangular teeth on one side<br>Example: inferred thrust faults          |
| 9    | 7         | 102/103    | Heavy dotted lines 0/1 pen with triangular teeth on one side<br>Example: concealed thrust faults |

Code group 100-199 symbols, with posting from an ASCII table. Reserve codes 100-115 for geologic entries; and be sure that the name of the ASCII data file for related data is included in the plot file created for the map.

Code group 200-299 Individually rotatable symbols. These symbols have standard geologic meanings. Uses and "standardization" of codes are defined by the CONFIG9.SYM file

Code group 300-399 symbols. Some of the symbols in the CONFIG9.SYM file have standard meanings; others don't. Any code can be used for any symbol. Reserve codes 300-315 for the geologic entries, and use higher numbers for cultural features, index points, geography, etc.

Code group 400-499 polygons. Reserve 400-415 for geologic features, and use higher numbers for cultural features, geography, etc. Code group 800-899 works the same as the 400's, just provides for the larger number of polygon types needed for very complex maps.

Code group 500-599 alphanumeric entries drawing from an ASCII file. Separate different kinds of uses. We suggest that 500-515 be reserved for geologic entries, and that 555 be used for labels for geologic units. These labels may be an important part of the data base if the digital data is exported to a GIS system. We strongly suggest that these labels be clearly separated from other types of text. If there are labels for features such as areas of rock alteration, these labels should be entered using a separate and different code. This will simplify later use of the digital files. Multiple ASCII files can be used for codes in the 500-599 and 700-799 groups, but only one for a particular code. Consistency is needed. We suggest that the name of the file used for labels for rock units should be DATABASE.RU; if another file is needed, use a different extension.

Code Group 601-699 Splined lines and decorated lines. Reserve codes 601-615 for geologic lines



| Code | Line type | Decoration | Specification                                                                                                         |
|------|-----------|------------|-----------------------------------------------------------------------------------------------------------------------|
| 601  | 0         | 0          | Fine solid lines, 00/000 pen<br>Example: trace of axial surface of fold                                               |
| 602  | 3         | 0          | Fine dashed lines, 00/000 pen<br>Example: inferred trace of axial surface of fold<br>Example: concealed thrust faults |

Code group 700-799. More alphanumeric characters. These codes are most appropriately used for features that will be plotted on a slant, such as names of faults and streams, or with characters spread along a line. We would suggest that they not be used for rock unit labels because leaders may be required.

Plan for use of utility programs. For example, if polygons share borders, digitize the margins in segments using a unique code for lines not to be used in the final illustration, like 99, then assemble the polygons using GSMPBLD, see p. 81. Less work yes.

#### A quadrangle map from start to finish

Many digital projects involve compilation of data from original sources using geodetic coordinates. Although the digital map fits inside the data base corners, there's no room for the Explanation and other required information that must be plotted around the map to finish the job. All projects are expedited by careful and early planning. Steps below are recommended for a project such as a complete geologic map of a 7 1/2 minute quadrangle.

Prepare the plot control, projection, and text files for data inside the borders of the map (for geodetic coordinates) before touching the digitizer.

Use the USMUTIL program's Option 13 to prepare the map's border lines, e.g. start data base #1 for a 7 1/2 minute quadrangle by specifying that the grid should be 7 1/2 minutes in size for the 7 1/2 minute area. This will generate four lines meeting at the corners with numerically exact map coordinates (data base #1).

Digitize the lines on the map (solid and dashed contacts, faults, but not dotted lines) that bound areas of different rock types (different colors on a color copy) into data base #1 from a scale-stable original. Digitize all lines from intersection to intersection (node to node). Check by plotting.

Use the edit mode of GSMEDIT to break the border lines exactly at each intersection with digitized lines. Re-sequence the data base so that the border lines are the first entries using Option 1 of GSMUTIL into data base #2.

Use Option 10 of GSMUTIL to snap the ends of the digitized lines inside the map in data base #2 to the exact coordinates of the border lines into output data base #3. It will work this way because the entries defining the border lines are in the data base before the other digitized lines.

Copy the entire contents of data base #3 into data base #4. This saves #3 for polygon building.

Complete digitizing of point and line elements of the map into data base #4. Check by plotting.

Use the GSMPBLD program (or the GSMPBS program if the polygons can be adequately seen on the screen) to build the outlines (polygons) for each rock type from the digitized lines in input data base #3 into output data base #5 (polygons only). If done from this data base there are a minimum number of lines to be tested by the line identification procedures of GSMPBLD (or GSMPBS). Check the polygons by plotting.

Merge data base #4 and #5, into data base #6, Option 7, GSMUTIL. Data base #6 finishes the map inside the quadrangle borders. It should be tested by plotting.

Copy the geodetic plot control file, change the line providing the X and Y scales to one designed for use with Cartesian coordinates.

To finish the map, adding the Explanation, index maps, bibliography, and other parts of the marginalia, we recommend shifting to Cartesian coordinates. This is easily done using Option 11 of the GSMUTIL program to generate a new data base in Cartesian coordinates scaled in plotter inches. AT this stage, as a part of this procedure, an X,Y data base #7, should be created that is large enough for the map and all of its marginal information.

We'd suggest creating the major elements of the map's collar as separate data bases , the Explanation, sections, index maps, and such so that each can be edited and checked separately. Then, with Option 7 of GSMUTIL, the separate parts can be merged digitally, in just the same manner as the physical paste-up of separate pieces of paper. Although it's possible to create new plot corners, digitize marginal information outside the data base corners, then plot the whole, it's better to look at finishing the map as a project for an X,Y coordinate system.

Publish the digital files as well as a paper map. No telling which will be worth more in future years. Accept the plaudits of the Earth science community with grace.

#### Archiving GSMAP databases

Nothing is deader than last week's set of files unless it's someone else's files from last year. GSMAP data base files and the associated plot files and projection files may constitute something of more than immediate value. If so, copies should be "archived". Remember to include a copy of the CONFIG9.SYM file. Remember that this can be modified by the user, and hence can be changed. Your fully annotated plot file will be invaluable to a subsequent user. You might even write a README file to jog your own memory - for example, what kind of pens go into which positions in the carousel and which version of GSMAP was used. Even more important might be comments about the data base, was digitizing done from scale-stable copy; what was the scale of the map used for digitizing; was it digitized for use at the scale of digitizing; was the data filtered, and if so with what tolerance at what scale. This "history" may enhance the value of the file to a future user of your data.

## Real maps

Green line mylar maps are always right. ?? **RIGHT !!** But check **before** digitizing. Checking requires construction of the proper projection file and a simple plot file; both will be needed eventually. Note that many of the map bases that we use have been made by splicing a number of quadrangle maps together. This makes a mosaic, not a true projected base map. The match with a plot from a geodetic GSMAP data base and the validity of digitizing will depend on the precision of the splicing, the projections of the pieces, and the phase of the moon. Each piece can surely be digitized individually, but the composite may not fit. In a worst case use Cartesian coordinates, recognizing that the final must fit a particular non-projected mosaic.

Check the fit of overlays starting with the corner points. Do this first, before digitizing, and before plotting an entire map. You can be sure that if the corners don't match, the rest of the map won't either. An easy way to check is to make up the proper projection file, and a plot file with corners specifying the corners of the base that will be used in digitizing and which must be matched (later) in plotting. Remember that the corners plotted in GSMAP are those specified in the plot file, not those of the data base, unless you want them to be. Any data base can be used for a test plot. All you need is a plot file with the proper corners and at the proper scale. No CODES need be plotted; a 0,0,0,0, to end the file will suffice, the corners can be plotted (Yes, plot the corner braces), and geodetic tick marks at an appropriate spacing. These index marks can be compared with those on the base map. If there is a problem don't go farther until the source of the problem can be identified. Some problems might be use of an inappropriate projection file, the wrong corners on the plot file, misidentification of latitude, longitude marks on the base or mismatch of scale of map and plot. Later, the data base used for digitizing should be checked by digitizing some of the points on the map with known latitude and longitude. A printout of the coordinates of some of these points will either inspire confidence or mandate a new start.

Mark the corners to be used in digitizing. Make them easy to find and easy to reoccupy with the cursor on the digitizer. A shallow cross cut into a mylar sheet with a knife blade leaves no room for doubt as to the location of the data base corner.

Two sets of latitude/longitude corners on the same map? There are notes on many recent 7 1/2 minute quadrangle maps that should be read. For example "Polyconic projection 1927 North American datum", "To place on the predicted North American Datum 1983 move the projection lines 7 meters north and 51 meters east as shown by dashed corner ticks". Which to use ? The corners of the map area that's been contoured have latitude/longitudes using the 1927 datum. Stick with the 1927 datum, at least for the present.

The GPS (Global Positioning Systems) devices have a direct readout in NAD 83 latitude longitude coordinates. These must be transformed to NAD 27 before entering into a NAD 27 data base. Conversion software is available, both in the Public domain, and in software provided with GPS devices. Just remember which is which, and stick with one system. Yes, GSMAP will work in the NAD 83 system if projection files use the correct polar and equatorial radii; the algorithms for digitizing and plotting are the same.

During operation of GSMAP error messages on the screen may indicate problems. Some of these messages are coded within the programs, others come from Basic, the language of the programs. Pay close attention, and write down or screen print the text, as it will furnish a clue as to the problem.

#### INPUT PAST END

Some error messages are readily understood, others are misleading. INPUT PAST END ... In many cases this message is due to an error in punctuation of ASCII files used by the program. If you see this message check all of the files being used ... projection files, plot files, data files ... each in turn. Make sure that all commas and quotation marks are properly placed. Blank lines at the beginning or end of a file may cause the same message.

#### NOT FOUND

If during plotting you see the message **Not found in CONFIG9.SYM (SYMBOL FILE)** and a symbol doesn't plot, check the data file. In one case a stuttering finger digitized P1 for an entry of code 300 as 1113 instead of 13. As symbol 1113 isn't defined, naturally the program couldn't find its definition in the appropriate place, the CONFIG9.SYM file.

#### AN ERROR HAS OCCURRED OPENING DATA FILE

If after a promising start, and plotting of some lines or symbols, the silent screen furnishes the following prompt just after starting to consider one of the 500 codes:

FILENAME FOR TEXT = DRAW.RU

AN ERROR HAS OCCURRED OPENING DATA FILE DRAW.RU  
CANNOT PLOT 500 SERIES DATA. HIT ANY KEY TO CONTINUE

The computer is trying to tell you that the data file isn't where it is supposed to be, and that it can't find it. Examine the plot file to see what you put in about the data file, and look to see where the file is located; it couldn't open the file because it couldn't find it. The file itself may be fine.

#### PREMATURE EOF IN BATCH CONTROL FILE

The plot file looks perfect, all commas in place. The plot's perfect **BUT** after finishing the plot, the screen prompts:

PREMATURE EOF IN BATCH CONTROL FILE HIT ANY KEY TO CONTINUE: you hit a key and return to the Main Menu! A \*HORSESHOE NAIL is missing from the plot file! There is no carriage return after the final line 0,0,0,0, and even though you may not be able to see it, the computer demands it to finish off the plot sequence, so it returned the system to the Main Menu. The plot file can have extra lines after the 0,0,0,0, entry: use them to annotate the file.

#### NADA

The plot file looks perfect, all commas in place; but it doesn't plot anything! It provides the message, **division by zero in line ....** Check the plot file to see if there is a blank line at the head of the file. The plot file did what you told it to do. Delete the blank line at the top of the file. Nada can also be reached if certain commas are missing from the first few lines of the file; the cause is the same.

#### BAD PARAMETER

A message on the plotter. The problem is almost certainly in the plot file. Check the punctuation of the plot file. A single missing comma may change the plot to draft mode or rotate it on the plotter, delete some lines, and make a quite unreasonable mess. Best, try plotting on the screen first, it takes less time, doesn't waste paper, and will catch problems with the plot file and with the availability of files, e.g. if you ask for font #3 and the file 3.FNT isn't in the active area.

#### STRING SPACE CORRUPT

After a promising start plotting lines, perhaps even a symbol or two, the screen prompts:

String Space Corrupt in line .....

A likely explanation is that the File CONFIG9.SYM has a problem. Perhaps when you added a symbol you left a blank line, or claimed that a symbol had a move more or less than it really did. Attempts to plot symbols located in the file after the error will draw the prompt warning of corrupted string space; plots of symbols defined in the file in lines before the mistake will be successful; this is an attempt by the computer to lull you into thinking that all is well, even when it isn't.

#### Geodetic vs. Cartesian

If you are working with data bases created with older versions and tell the computer that a data base is geodetic while it is Cartesian, or vice versa, it will seem at first that you are able to do so, but it won't work out. This answer will be stored in the .NDX file, so be careful that you don't lie, because GS MAP will catch you.

#### DEVICE FAULT

If the printer is not ready, but you ask for something to be printed, an error message like that below will be displayed: **Device fault in line 0 of module .....** (the number will depend on which printout has been specified; but the prompt: **Hit any key to return to system:** should get your attention. Hit a key, return to the DOS prompt and vow to do better. If you have insulted the computer recently it may send you a time out message, and have to be \*rebooted. Be kind.

#### DEVICE TIMEOUT

If the digitizer or plotter isn't turned on, but you ask for it to work, after a little time you may get a message starting with **Device timeout** and ending with **Hit any key to return to system**. Hit any key and return to the DOS prompt. The computer's just instructing you to get with it, so that it can do what you ask of it. Reasonable enough. When plotting this message may be displayed if there are communication problems between the computer and the plotter, i.e. the computer is too fast or the plotter too slow; the problem can sometimes be solved by reducing the baud rate (change both the setting on the plotter and the rate set on the first line of the file CONFIG9.PLT).

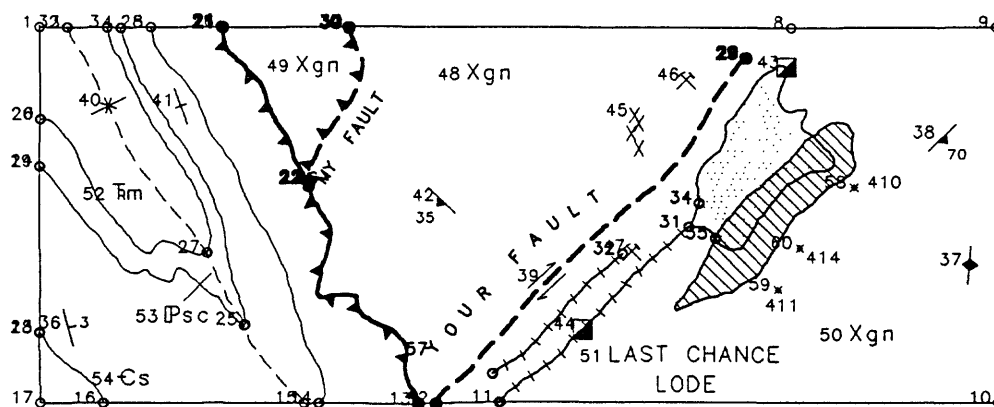
#### ILLEGAL FUNCTION CALL

If you attempt to use an EGA adapter that has less than 256 K RAM (such as the older IBM adapters), you will see a message starting with the **Illegal Function** prompt. There's no illegal function call here. The computer is lying to make up for lack of enough RAM in the EGA adapter card. It just doesn't want to admit even one shortcoming. EGA adapters with less than 256 K RAM can be used in CGA mode. Change the first line of the CONFIG9.SCR file, see \*Documentation, Appendix 1; of course you can't see different codes in different colors, or the higher resolution that you paid for. You may get the same error message on some systems if you specify EGA in the CONFIG9.SCR file, but leave the graphics card in CGA mode, even though the hardware's OK. Try it and see. The price is no more than rebooting the system. The computer will quickly let you know who's boss (and it ain't you). Certain computers and certain accelerator boards are not compatible with adapters and monitors in the EGA mode. The error message is about the same as above. Check the \*documentation for your hardware. The same message will be displayed in some operations if you inadvertently end up by specifying one of the scales as Zero. This can happen in a plot control file, an incorrect projection parameter file, and in other ways. You may find some new ones for us. In some of these cases the illegal function is just that: you attempted to divide by zero, and the computer correctly objected that dividing by zero is illegal, but left out the immoral and fattening advice that you also expected.

#### OUT OF MEMORY IN LINE 0

Can have several causes, some your fault, some related to DOS memory management. For example, if you use Option 9 and attempt to print a file in spite of advice in the documentation, you will tie up a portion of the limited available memory, and get this message if you request one of GS MAP's services that requires lots of RAM.

In the dimly remembered days of the beginning there was Open File Report 86-42; GSMAP without so much as a version number. Editing was simple. Find out the number of a flawed entry, delete it, then, re-digitize. End of options. Yes, that option is still available. But there may be a better way. Version 9 offers complete on-screen graphics and several ways of editing a map. Because of the limitations of DOS, that much-maligned lean and mean operating system, different ways of editing are offered in several executable programs. This guide may reduce the number of trips down the yellow brick road. With small and simple data bases any and all methods will work, but with large and complicated data sets there may be a most efficient way. Positive (+) and negative (-) indications are designated by appropriate signs. The time required for editing can be reduced by careful attention to procedure. We'd suggest that you make a hard copy printout of the plot control file (DATABASE.PLT) and the text file(s) (DATABASE.RU). Then when editing using Option 3 of GSMAP or GSMEDIT, window early and often during operations. Draft mode plots and draft mode plot control files can play an important role in the edit process. An example of a draft mode plot is provided below.



55 GEOLOGIC MAP OF THE EXERCISE AREA

Fig. 13 Draft mode plot of the tutorial exercise.

## Tools for editing

### GSMAP

Option 3. Edit functions using digitizer as pointer: + CGA graphics can be used but EGA or VGA graphics are desirable, editing indexed to hard copy, changes are seen relative to neighboring entries on-screen, immediate access to digitizing of new entries by changing mode from edit to input; - digitizer required, hard copy required, windowing generally required if screen display is to be used to monitor editing, indexing of hard copy to digitizer required, may be slow.

#### Functions:

- Delete a point or an entry.
- Break a line into segments
- Change parameters for an entry.
- Move a point.
- In Input mode of Option 3, add entries as you wish.

Option 4. Delete entries by number: + Fast, digitizer and hard copy not required; - # of entry must be known, can't delete one point from a multi-point entry.

Option 5. Recover entries by entry number: + This option provides the only way to undelete an entry, - # of entry must be known, use listing specifying codes by number (not -1 for all) to see which entries of which codes have been deleted.

Option 6. Change code or parameters 1 or 2, individually or globally by CODE: + Fast, the only way to accomplish global change; - # of entry must be known except for global changes.

Option 7. List contents of a data base: don't ignore the information in this listing even though this option has no direct edit function.

Option 8. Use draft mode plots to identify entry numbers and first points of lines. Besides, without hard copy for proofing who'd find mistakes in the first place?

## GSMEDIT

On-screen edit using the arrow keys or a mouse to move an on-screen cursor to point to a particular entry: + digitizer not required, hard copy not required, indexing of hard copy to digitizer not required, changes made in of editing seen immediately on screen; - EGA or VGA graphics usually required, CGA generally not adequate, editing not indexed to hard copy, but changes displayed relative to neighboring entries on-screen, multi-stage windowing generally required for accurate editing, may be slow. If a draft mode plot file is used, small circles will be drawn around the first and last point of each line or polygon.

### Functions:

- Delete a point or an entry.
- Change parameters for an entry.
- Break a line into segments.
- Move points one at a time to new positions.
- Digitize a point, line, or polygon.
- Reverse the sequence of points making up a line.
- Digitize and add a single line text entry to the text file.

## GSMUTIL

Option 1, select entries by code from an input data base and generate an output data base (an easy way to delete all entries belonging to one or more codes by not selecting them into the output data base).

Options 2 and 4, convert contents of a data base to an ASCII file, then edit the ASCII file using a text edit program, then convert back to a GSMAP data base: + This provides the ultimate character-by-character control for editing, data base corners and title can be changed; - some changes very slow, best you know what you are doing, but they you do, don't you, and you have complete back up's too.

Option 3, select entries from a data base inside one or more a trim polygons defined in a GSMAP data base: + easy to generate polygons by digitizing, one or many polygons can be used in one pass; - mathematically exact coordinates difficult to attain. Use Option 1 to quickly generate a data base with the same corner coordinates as your data base.

Option 5, select entries from a data base inside one trim polygon defined in an ASCII file: + works best if the number of points in the trim polygon is small and if their coordinates must be precise, i.e. select data inside a 7 1/2 minute quadrangle from a data base that covers a 1 x 2 degree sheet; - time consuming to generate file if polygon has many points, limit one polygon.

Option 7, merge data bases: work when possible with small files, they are more easily generated, easier and quicker to edit, then merge them together for the grand finale.

Option 9, filter a data base: filter to reduce the number of points to a minimum, this not only reduces the size and gets rid of deleted entries, but makes subsequent editing faster, speeds up plotting and makes better plots.

Option 10, snap nodes (codes 1-99): joins lines end to end if points are within a specified "snap" distance, also to joins intermediate points on lines to the ends of "almost" contiguous lines, makes intersections mathematically accurate; + cleans up a data base for export to other programs, - may produce undesirable changes if too large a snap distance is chosen, that's why there is no default snap distance.



## GSMPBLD

### Function:

To select lines from an input data base and structure the entire area into closed polygons in an output data base. before starting program, input data base must be edited to contain only lines needed for output data base. No hard copy needed with Version 9.

## GSMPBS

### Function:

To select lines from an input data base and export lines, composite lines, or closed polygons to an output data base using cursors on the screen moved by using arrow keys or a mouse to select line segments: + powerful; - all line segments must be available before starting program. Lines segments that form a wall-to-wall polygon can be assembled by zooming to view selected parts as lines are being selected. The output data base can be merged with the input data base. This makes step-by-step editing easy. No hard copy required. GSMPBS will find the line segments and arrange the points in the sequence selected. This program is probably the best way to make GSMAP polygons out of line segments if a color EGA or VGA system is available, especially with the use of GSMEDIT draft mode for editing

### HOW TO CHEAT FAIR WITH GSMAP

This section on problem solving descends from a part of the tutorial written for GSMAP Version 4.0. You didn't read it then, but now, in a section with a different title, perhaps you will. Some of the problems have changed, the intent is the same... to assist you in understanding GSMAP. As you gurus know, plot limits are set in two ways. One is set by the hard clip limit of the plotter. This you may be able to foil by using a bigger sheet of paper. Second, by the minimum and maximum values for X and Y provided by the plot control file. Right?

### Plotting letters and numbers out of bounds

The problem to be solved is illustrated by the diagram on the next page. The data base corners are at the corners of the square. Can you use the indexing feature of GSMAP Version 8 (indexes corners set by the plot file), yet plot the labels for the ends of a section, or annotations below the map outside the limits set by the plot file? If the answer was NO would we discuss it here? Yes, but this time you are in luck. One of the features of GSMAP, both with geodetic and Cartesian coordinates, is that soft clip limits apply to data points, not plotter strokes. Examine the text (.RU) file printed below.

```
1, " "  
" "  
"Geologic mapping"  
"  stolen from "  
"    an      "  
" unnamed source ",  
"EOT"
```

The data point indexing the lines of text must be digitized above all of the text. Now do you see how the 500-599 codes can be used to plot below and to the right of the data base corners? Digitize the data point inside the data base corners, let the plotter stroke the letters outside.

Yes, you respond, that lets you plot below and right, but not left or above. How about the A that labels the left end of the section? Examine the data file printed below. Any ideas?

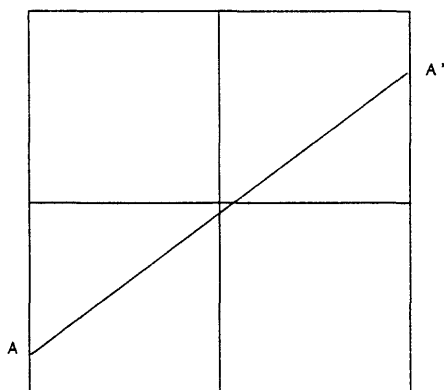
```
1, "  A", 10, 100, 200  
2, "JJ A'", 100, 200, 5
```

The 100-199 codes, that oft forgotten group, can plot to the right or left of a data point. These codes aren't restricted to numbers, but can handle alphanumeric entries if these are surrounded by quotation marks. The A and the A' in the diagram were done in this way. But why the funny character to the left of the A in the second line of the file? Blanks to the left of a label will be trimmed, but in the Font #0 used for these labels, a blank will be plotted for undefined characters and ASCII 245 isn't defined in Font #0. Also possible, digitize a

2-point entry in a code 100-199. Put the first point inside the data base, the second (for posting) at the position for plotting the text. The text located by the second point will plot on the plotter even if this point is outside the data base window if the first point is inside. You can see these entries on the screen using option 8 of GSMAP if you set a plot window larger than the data base window using the plot control file, or with GSMEDIT if you use the keyboard mode, and use the arrow keys to set a screen window outside the limits of the data base (can't be done in mouse-mode).

### Crossing the International date line

'GSMAP knows that the corner points on the West side of the plot control file (or data base) are West of the ones on the East side. Do you? When going to the plotter (which operates in an XY system and can't plot on a globe), GSMAP sends coordinate points accordingly. If you need a plot that crosses the international date line (longitude 180 degrees East or West), you must recognize the dilemma facing the program. The problem can be solved. Recognize that 170 degrees East is the same as 190 degrees West. GSMAP knows that 170 degrees East is east of the International date line, 190 degrees West is west of the International date line. Don't let practices taught in High School geometry (due to rationing of numbers) control the way you do business with GSMAP. For example, you can plot a map of the World using the Mercator projection from 260 West to 100 East (to put Washington D.C. (longitude about 78 degrees West) close to the center of the map. remember to set the longitude of the Projection file at 80 W (the projection breaks down more than 180 degrees from the principal meridian) or all you'll get will be an error message about an illegal function, or nothing, just as you will, if you try to plot at 90 degrees, North or South latitudes with the same projection, so cut off at a reasonable place. If you've got data going to 90 degrees latitude, like a geodetic grid, GSMAP will tell you to shape up. Use GSMUTIL, Option 5, "trim on polygonal border defined in an ASCII file", to trim the data down to size. Trim data so that no line crosses the International Date Line. You'll probably wind up with two data bases, one east of the line, the second west. On the one to the west, don't use codes 1-99 or 400-499; for lines, use splined lines 600-699. Check using screen plots to make absolutely sure that lines don't cross the date line. If you want to draw geodetic grid lines, generate them from 260 W to 100 E, then GSMAP recognizes the E and W of it all.



Plotting out of bounds

Geologic mapping  
stolen from  
an  
unnamed source

### Digitizing and registering plots of ternary diagrams using GSMAP

#### Dukas 1897 revisited

The problem to be solved involves use of the plot register indexing feature of GSMAP Version 9, but also serves to remind you how the vertical and horizontal directions and scales are set when using GSMAP with Cartesian coordinates.

How can you digitize data from a ternary diagram, then use the indexing feature of GSMAP Version 8 to plot the digitized data on a sheet of ternary graph paper. Let's assume that you have a sheet of ternary graph paper will fit into the plotter.

Let's use the counter-gambit after Dukas 1897, first published in 1987. Use GSMAP Option 1 to start a data base, specify corners using method 2. Specify the upper right corner coordinates  $X=8.660025$ ,  $Y=10$ . Make up a plot control file with the codes you wish to use, specifying use of the data base corners.

Next, fasten the ternary diagram on the digitizer board. Remember to use the left corner of the base of the ternary diagram to index the upper left corner of the data base, the lower right corner of the diagram as the lower left corner of the data base, the top of the diagram for the lower right corner of the data base, and the same point to index the upper right corner of the data base. Make sense? In this way, the "vertical" direction is set along the base of the diagram, and the Y scale by the distance between the two lower corners, the X scale by the distance between the base and the top of the diagram (hence the  $X=8.660025$  to match the  $Y=10$  coordinate. Digitize the data points or lines needed from the diagram.

Finally, put the ternary graph paper in the plotter, then, use the plot-register PR response, GSMAP option 8 for plotting on the plotter. Register the proper corners (remembering the definitions above, run the plot, and you're done.

This should remind you that the vertical direction is set by the two left corners of the data base, the horizontal is perpendicular to the vertical (not set by data base corners) and the fourth corner relates to plot and screen windows, not to indexing digitizing and plotting or to X and Y scales.

#### Scale changes, PR option

If a plot is to be made at a size different from that specified by the plot control file using the PR option, program will modify the scale specified in the plot control file to compensate for scale differences. The sizes of all elements including the 200-299 codes will change, so adjust the scales indicated in the plot control file appropriately. This holds true for plots from geodetic data bases using the PR option.

#### The Empty Quarter

##### Major scale changes, PR option

Yes, you can subvert the original intent of the PR option so that dip and strike symbols can be read clearly from 20 feet away on the giant copy of the map you are preparing for your next poster session on the Empty Quarter. Instead of changing the scale in the plot control file, use the PR option, and register the plot to large-size corners so that all of the entries will be plotted over-size.

## CHAPTER 4

### PROGRAMS THAT DRAW DATA FROM GSMAP DATA BASES

#### GSMROSE

GSMROSE is a program enabling construction of rose diagrams from linear data (lines or polygon boundaries) in GSMAP data bases to assist analysis of the trends of linear data.

#### Required files

##### Program file:

GSMROSE.EXE: the executable program file for GSMROSE.

##### Configuration files:

CONFIG9.SCR: the screen configuration file.

CONFIG9.PLT: the plotter configuration file.

##### Font file:

0.FNT contains the definition of the letters and numbers used to label plots.

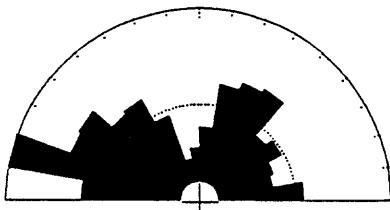
The program file GSMROSE.EXE and the configuration files CONFIG9.SCR and CONFIG9.PLT configured to match the system, and the font file 0.fnt should be on the active drive of the microcomputer unless the setting of the environmental variable specifies a different location.

##### Data base files:

The two GSMAP data base files, extensions .NDX (index file) and .LSF (line segment file) e.g. DATABASE.LSF and DATABASE.NDX from GSMAP (geodetic or Cartesian coordinates) are required for the data base to be used.

##### Projection files:

Files containing map projection parameters (projection files) are required for GSMROSE when used with geodetic data. These files are the same as those required by GSMAP Versions 6-8. Map projections and the contents of projection parameter files are described, pages 145-149.



Rose diagram plotted from edited GSMAP data base generated by GSMROSE.

## Options

The user can specify the radius of the diagram, the angular measure of the sector used for analysis, and output to the screen, to a plotter, to a disk file written in HPGL (Hewlett Packard Graphic Language), or a GSMAP data base in Cartesian coordinates (new to this version). After preparing the rose diagram, a table can be printed that provides the numeric information used in constructing the diagram.

Two methods of analyzing linear data are provided, one length-weighted, the second count-weighted.

1. When using the length-weighted option the program reads the data for lines or polygons with a specified code in a data base, calculates the bearing and length of each interval between points along the lines, accumulates these lengths for angular sectors of bearing as specified (e.g. if 5 degrees was specified, for 0 to 5, 5 to 10 and so on through 175-180), calculates the total length of line segments in each sector, and divides the length in each sector by the length in the maximum sector. This ratio is used in the rose diagram as the radius for the sector. The radius of the diagram for the sector of maximum length is chosen by the user. For data bases that use Cartesian coordinates the Y coordinate of the data base is used as the Y coordinate (0 degrees) for the rose diagram.
2. When using the count-weighted option, the program reads the data for lines (not closed polygons) with a specified code in a data base, calculates the bearing of the line connecting the first and last point of the line, and records the number of entries for each 5 degree sector. The sector containing the most entries is plotted to the radius specified, the others are scaled to this distance according to the number of entries. For geodetic coordinates and most of the projections supported by the GSMROSE program, the line of longitude used as central meridian in the projection parameter file is used as the Y coordinate (0 degrees) for the rose diagram. The 0 degree position is marked by a long tick mark, the 90, 180, and 270 by slightly shorter tick marks, and each angular sector as specified by short tick marks. After drawing a rose diagram a table can be printed that provides the number of entries, the total length in kilometers of all of the lines, the length of the lines in the sector of maximum length, and the length of the lines in each sector as chosen, or the number of entries and the number in each sector.

Data for lines, codes 1-99, and 600-699, and polygon margins, codes 400-499 and 800-899 can be used to generate length-weighted diagrams, that for lines codes 1-99, 600-699 to make entry-weighted diagrams. The digitized data points, are used for codes 600-699, not the points as splined by GSMAP when lines with codes 600-699 are plotted.

On the each plot drawn by GSMROSE, dotted circles are drawn at 10 percent and 50 percent of the radius specified, and a circle drawn with a solid line at the radius specified (100 percent of the maximum value for the maximum sector). The name of the data base and the code specified are plotted above and to the left of the rose diagram.

The directions and lengths of lines on a map plotted from a data base using geodetic coordinates are dependent on the map projection used. For example, lines of longitude drawn using the Mercator projection are straight lines parallel to the Y axis, but on the Lambert Conformal Conic projection these north-south lines are drawn as curved lines converging at a pole. GSMROSE plots derived from geodetic data reflect these differences in map projection. The effects of different map projections shown by GSMROSE diagrams are small for areas up to that of a 1 degree by 2 degree sheet. A 3 to 5 degree class interval will cover most of these effects; the quality of data rarely warrants a smaller interval. This can not be said for large areas and certain map projections. The effect of map projection should be considered when using GSMROSE with geodetic data bases. We don't recommend use of the GSMROSE program with geodetic data bases for areas larger than a 1 degree by 2 degree sheet.

## OPERATION OF GSMROSE

Turn the plotter and printer on. Start the GSMROSE program by entering **GSMROSE**. After a brief pause during the loading of the program and the font file, the first prompt will call for entry of the name of the data base to be edited, and the screen will show a list of files in the default area with extension **.NDX** (available data bases in this area):

**ENTER INPUT DATA BASE NAME:**

Enter the name of the data base to containing the data to be used for the rose diagram. Enter the filename without extension(s). You may see the next prompt and if you do, answer appropriately:

**CANNOT IDENTIFY TYPE OF DATA BASE**

**IS THIS A GEODETIC OR CARTESIAN DATA BASE?(G/C):**

Enter **G** if geodetic or **C** if Cartesian. If geodetic the screen will display the names of the files in the active area with extension **.PRJ**, and the prompt:

**ENTER FILENAME OF PROJECTION PARAMETERS (DATABASENAME.PRJ)?** The default projection file is shown by the prompt. Either use the default file (hit **ENTER** key), or enter the full name of the projection file to be used.

This prompt will be skipped if the file uses Cartesian coordinates. The next prompt will be:

**ENTER CODE (0 TO EXIT):**

Enter the code of the entries to be used in drawing the rose diagram. Codes 1-99,400,499,600-699 can be used as these define lines or outline polygons. The next prompt will be:

**ENTER RADIAL WIDTH IN DEGREES(1 TO 10):**

Enter the radial width of the sector interval that you want. The width can be 1-10 degrees; there is no default value. Values of 7 and 8 are prohibited as they may generate anomalies because they are not factors of 180. The next prompt will be:

**ENTER PEN,RADIUS,XOFF,YOFF:**

Enter the values you wish to select, separated by commas. These values will be used in plots to the screen (to select color), to the plotter, and for HPGL files. The next prompt will be:

**ENTER WEIGHTING OPTION 0=LENGTH, 1=COUNT**

Enter **0** if you want a diagram weighted by length of lines in each sector. Enter **1** if you wish weighting according to the number of entries in each sector.

If plots are to be drawn on the screen:

Enter the number of the color desired (see list p. 169) as the pen number, then enter a small number (1 works well) for the radius of the diagram, then an X offset of 0 and a Y offset of 0, e.g. **14,1,0,0** for a yellow display (pens 1-15 can be specified). Offsets are ignored if screen output is chosen. The radius of the circle is immaterial, as this value will automatically be scaled to use the largest possible area on the screen.

If the plot is to be made on the plotter or to a disk file:

Enter the number of the pen to be used to draw the rose diagram on the plotter, the radius of the circle desired, the X offset, and the Y offset. The radius and offset values are entered in inches. Four numbers separated by commas are required to respond to this prompt.

The next prompt provides a choice of output to the screen, to a plotter, or to a disk file.

**PLOT TO SCREEN,PLOTTER,DISK? (S,p,d):**

Enter **S**=screen, **P**=plotter, or **D**=disk file, the default is to the screen.

#### Screen

If you enter **S**=screen the program will operate. A Rose diagram (scaled to use the entire screen) will be displayed. The screen display will stay on the screen until you hit an key.

#### Plotter

If you enter **P**=plotter the next prompt will query:  
**ROTATE?(y/N):**

Enter **Y** (yes rotate) or **N** (no) (the default is **N**). A message will be displayed  
**PLOTTER SHOULD BE TURNED ON AND PAPER LOADED!!!!**  
**HIT ANY KEY WHEN READY**

Hit any key when ready. The program will operate and plot a rose diagram on the plotter.

#### Disk

If you enter **D**=disk the program will prompt for entry of the name of the file where plot data is to be written.  
**ENTER DISK FILENAME:**

Enter the name of the file (full name with extension). The next prompt calls for entry of scaling points:  
**P1X,P1Y,P2X,P2Y:**

Enter the scaling points to be used for the plot (e.g. **80,320,10080,7520**)**B**. A brief discussion of scaling points is provided on p. 336. Consult the manual for the plotter to be used. After entry of the scaling points the next prompt will ask:  
**ROTATE (Y/N):**

Enter **Y** or **N**. See p. 336 for a brief discussion of "rotation" of plots on a plotter.

After completion of the plot to the screen, on the plotter, or to a disk file, the prompt below will be displayed:  
**DO YOU WANT TO PRINT A TABLE OF VALUES?(y/N)**

Enter **Y** or **N** (the default is **N**). If you enter **Y** and the printer isn't ready, or there is no printer, the system will time out and return operations to the DOS prompt. If you answer **Y** and the printer is ready a table of values as shown below will be printed.

After completion of the print of the table of values, or a **N** answer to the prompt, the screen will prompt:

**DO YOU WANT TO CREATE A GSMAP (Cartesian) DATA BASE(y/N)?** If you respond **Y** the next two prompts will be displayed, if **N** these will be skipped, the default is **N**.

**ENTER OUTPUT DATA BASE NAME:** Enter the name you wish to use for the GSMAP data base.

**ENTER TITLE:** Enter the title to be used for the GSMAP data base. We suggest that you use a title that reminds you of the code selected, e.g. **CODE 25**).

The prompt: **ENTER CODE (0 TO EXIT:** will be displayed again to provide opportunity for plotting of another diagram (same or different parameters) from the same data base. Enter **0** to return the system to the DOS prompt.

Parameters of GSMAP data base:

Coordinates of corners, X,Y (R=radius selected for outer circle)

Lower left = 0,0

Upper left =  $0, 2 \times R + 0.2$

Lower right =  $2R + 0.2, 0$

Upper right =  $2R + 0.2, 2R + 0.2$

Codes:

Sectors defined as closed polygons, code 1

Circles and tick marks defined as lines, code 2

The center of the diagram will be at  $X=R+0.2, Y=R+0.2$

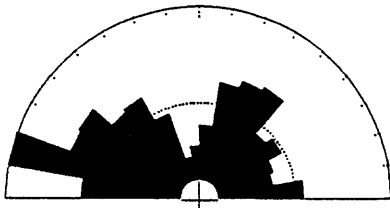
If a half diagram is needed (N half) an ASCII trim file can be used to select a part of the GSMAP data base using option 5 of GSMUTIL. The example below can be used if a one inch radius has been selected.

```
0.0,2.2
0.0,1.02
2.2,1.02
2.2,2.2
0.0,2.2
```

The sample GSMAP plot control file printed below used if a solid fill is needed for the sectors. Change entries CODE=1 to CODE=401, add a few lines using GSMEDIT

```
Y
1.0,1.0
0,0
N
N
12,2
1,1,0,0, "ROSE DIAGRAM SECTORS"
2,2,1,0, "CIRCLES "
401,2,0,0, "SOLID FILL"
4,0.004,0,2,0
50,1,0,0, "MAP OUTLINE"
0,0,0,0, "END OF PLOT FILE"
```

GSMAP PLOT FILE FOR DATA BASES FROM ROSE DIAGRAMS





## Table of values

The table of values provides data on the lines analyzed to produce the rose diagram. An example of the table produced after generating the length-weighted rose diagram to its right is provided below. Values for 5 degree sectors, 0-180 are printed. As direction is dependent on mechanics of digitizing as well as on trend, and the rose diagram plot is based on trend, data in sectors 180-360 are the same as for sectors 0-190 as the diagram is centrosymmetric, and therefore are not printed.

DATA BASE= A:MP  
 CODE GROUP 11 CONTAINS 139 ENTRIES  
 MAXIMUM DISTANCE= 3.18 KILOMETERS  
 TOTAL DISTANCE= 32.69

| FROM | TO  | DISTANCE | %    |
|------|-----|----------|------|
| 0    | 5   | 0.27     | 0.84 |
| 5    | 10  | 0.49     | 1.50 |
| 10   | 15  | 0.51     | 1.57 |
| 15   | 20  | 0.68     | 2.09 |
| 20   | 25  | 0.92     | 2.81 |
| 25   | 30  | 2.25     | 6.89 |
| 30   | 35  | 2.69     | 8.24 |
| 35   | 40  | 2.71     | 8.28 |
| 40   | 45  | 3.18     | 9.72 |
| 45   | 50  | 2.65     | 8.10 |
| 50   | 55  | 2.59     | 7.91 |
| 55   | 60  | 1.84     | 5.63 |
| 60   | 65  | 1.94     | 5.94 |
| 65   | 70  | 1.65     | 5.04 |
| 70   | 75  | 1.28     | 3.92 |
| 75   | 80  | 1.22     | 3.74 |
| 80   | 85  | 1.27     | 3.89 |
| 85   | 90  | 1.63     | 4.99 |
| 90   | 95  | 0.55     | 1.69 |
| 95   | 100 | 0.72     | 2.20 |
| 100  | 105 | 0.49     | 1.50 |
| 105  | 110 | 0.24     | 0.72 |
| 110  | 115 | 0.15     | 0.45 |
| 115  | 120 | 0.04     | 0.12 |
| 120  | 125 | 0.17     | 0.51 |
| 125  | 130 | 0.00     | 0.00 |
| 130  | 135 | 0.03     | 0.10 |
| 135  | 140 | 0.03     | 0.09 |
| 140  | 145 | 0.06     | 0.18 |
| 145  | 150 | 0.00     | 0.00 |
| 150  | 155 | 0.03     | 0.08 |
| 155  | 160 | 0.01     | 0.04 |
| 160  | 165 | 0.03     | 0.09 |
| 165  | 170 | 0.11     | 0.33 |
| 170  | 175 | 0.20     | 0.62 |
| 175  | 180 | 0.05     | 0.16 |

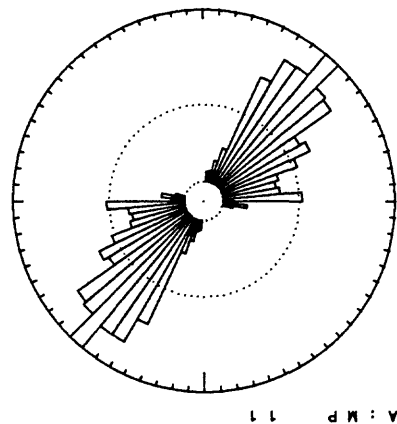


Figure 14. Length weighted rose diagram Code 11

The table of values below is drawn from the same data set as that on the preceding page, but the rose diagram is weighted by according to the number of entries in each 5 degree sector. Values for 5 degree sectors, 0-180 are printed. As direction is dependent on mechanics of digitizing not on trend, and the rose diagram shows trends only, values for sectors 180-360 would be the same as those for sectors 0-190 and therefore are not printed.

DATA BASE= A:MP  
CODE GROUP 11 CONTAINS 139 ENTRIES  
MAXIMUM Number= 17

| FROM | TO  | NUMBER | %     |
|------|-----|--------|-------|
| 0    | 5   | 2.00   | 1.44  |
| 5    | 10  | 1.00   | 0.72  |
| 10   | 15  | 3.00   | 2.16  |
| 15   | 20  | 3.00   | 2.16  |
| 20   | 25  | 3.00   | 2.16  |
| 25   | 30  | 8.00   | 5.76  |
| 30   | 35  | 13.00  | 9.35  |
| 35   | 40  | 7.00   | 5.04  |
| 40   | 45  | 9.00   | 6.47  |
| 45   | 50  | 17.00  | 12.23 |
| 50   | 55  | 9.00   | 6.47  |
| 55   | 60  | 4.00   | 2.88  |
| 60   | 65  | 5.00   | 3.60  |
| 65   | 70  | 11.00  | 7.91  |
| 70   | 75  | 8.00   | 5.76  |
| 75   | 80  | 4.00   | 2.88  |
| 80   | 85  | 7.00   | 5.04  |
| 85   | 90  | 10.00  | 7.19  |
| 90   | 95  | 2.00   | 1.44  |
| 95   | 100 | 3.00   | 2.16  |
| 100  | 105 | 1.00   | 0.72  |
| 105  | 110 | 3.00   | 2.16  |
| 110  | 115 | 2.00   | 1.44  |
| 115  | 120 | 0.00   | 0.00  |
| 120  | 125 | 1.00   | 0.72  |
| 125  | 130 | 0.00   | 0.00  |
| 130  | 135 | 0.00   | 0.00  |
| 135  | 140 | 0.00   | 0.00  |
| 140  | 145 | 0.00   | 0.00  |
| 145  | 150 | 0.00   | 0.00  |
| 150  | 155 | 0.00   | 0.00  |
| 155  | 160 | 0.00   | 0.00  |
| 160  | 165 | 0.00   | 0.00  |
| 165  | 170 | 0.00   | 0.00  |
| 170  | 175 | 3.00   | 2.16  |
| 175  | 180 | 0.00   | 0.00  |

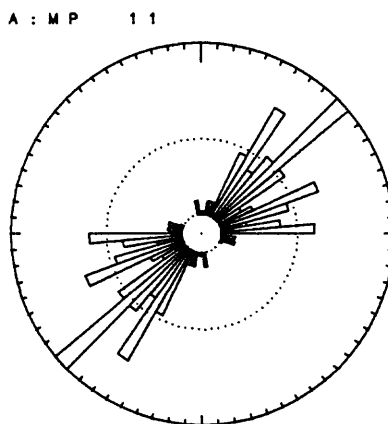


Figure 15. Count weighted rose diagram, Code 11

## GSMNET

GSMNET is a program used to produce stereographic or equal area plots from data on planar or linear features in GSMAP data bases, or from ASCII files. Graphic output is to the screen, to a plotter to an HPGL file, or to a GSMAP data base. Plots on the plotter will provide the name of the data base or ASCII file, code used, North line, and tick marks at 10 degree intervals. GSMAP conventions for symbols (right-hand rule) are observed. The configuration files CONFIG9.SCR and CONFIG9.SYM must be available to the program; CONFIG9.PLT must be available if output is to go to a plotter. Input data bases or ASCII files must be prepared before opening the program by entering GSMNET. Prompts are simple and familiar to GSMAP users. As is customary, respond to each in turn.

**PLANAR (1) OR LINEAR FEATURES:** Enter 1 or 2. The program plots the pole to a planar feature (lower hemisphere), or the projection of a linear feature (one GSMAP code).

**STEREOGRAPHIC (1) OR EQUAL AREA (2):** Enter 1 or 2.

**ENTER PEN, RADIUS, SYMBOL, SIZE,XOFF,YOFF:**

Respond, e.g. 3,2,1,40,1,2 for pen=3, radius=2", symbol #1, size 40/1000 inch, X offset=1 inch, Y offset=2 inches.

**ENTER TYPE OF INPUT DATA (1=GSMAP,2=ASCII):**

Enter 1 if drawing data from a GSMAP data base, 2 if drawing data from an ASCII file.

If 1 GSMAP data base:

**ENTER DATA BASE NAME:** Enter the name of the GSMAP data base.

**ENTER CODE:** Enter the code for the symbol, e.g.202. The values of P1 and P2 will be used as data input.

Be careful. If, for example you wish to make a plot of poles to foliation surfaces and use all data, you may need to create a special data base for use with GSMNET. Change symbol 222 (vertical foliation) to 202 with P2 of 90, add horizontal foliation symbols (your code 3XX, P1=60, P2=0 converted to code 202, to use all data on foliation in the data base, symbols number 202 (inclined), 222 (vertical) and \*\* (horizontal). You will still save time compared with plotting by hand.

**DO YOU WANT TO CREATE AN ASCII FILE OF SELECTED VALUES? (y/N):**

If Y

**ENTER FILENAME FOR OUTPUT ASCII FILE:** Enter the name for the ASCII file

**IF 2 ASCII: ENTER FILENAME:** Enter the name of the file containing the data.

**DO YOU WANT TO ROTATE? (y/N):** Enter Y or N (rotation rotates plotter output only)

The next prompt will ask for the type of output desired.

**SCREEN,PLOTTER,DISK (S,p,d):** Respond appropriately.

After the plot has been completed, a prompt will be displayed:

**DO YOU WANT TO CREATE A GSMAP CARTESIAN DATA BASE OF THE GRAPHIC? (y/N):**

If Y prompts will ask for the name and title of the data base.

**DO YOU WANT TO PROCESS MORE DATA? (Y/N):** Respond appropriately.

The format for data in the input ASCII file is very simple, and identical to the format of the output file. The angle of strike (planar feature) or plunge (linear feature) is followed by a comma or blank(s), then by the angle of dip or plunge.

|     |    |
|-----|----|
| 352 | 10 |
| 180 | 8  |
| 153 | 10 |
| 145 | 10 |
| 347 | 5  |
| 330 | 10 |
| 314 | 15 |
| 297 | 5  |
| 313 | 10 |
| 336 | 22 |

#### CODES USED IN OUTPUT GSMAP DATA BASE

Circle = code 91

Short tick marks = code 92

Long tick marks = code 93

Symbol at center of circle = code 399, symbol=9

Data symbols = code 398, user selected symbol and size

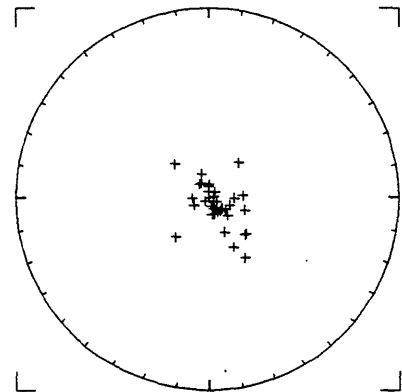


Figure 16. Diagram from GSMNET, plotted from GSMAP data base, data base corners plotted

## CHAPTER 5

### Profiles from contour maps

#### GSSECT

GSSECT enables quick and accurate generation and plotting of the topographic profile for cross sections, and other profiles drawn from contour maps. GSSECT supports almost the same hardware as GSMAP except that the GSSECT program does **NOT** support the use of a one-button digitizer. We consider that back and forth operation from a menu on the digitizer to the line of section to substitute for the use of multiple keys is not feasible.

#### Required files:

GSSECT.EXE program file  
CONFIG9.digitizer configuration file for the 16 key keypad  
CONFIG9.SCR Screen configuration file  
CONFIG9.PLT Plotter configuration file

These files should be in the active directory unless the environmental variable has been set to another location. If GSMAP has been installed, we suggest adding GSSECT.EXE to the directory containing the GSMAP program.

#### Preparation of hard copy before starting digitizing

GSSECT's limited capability for correcting mistakes during digitizing prompts these suggestions on preparing the hard copy that will be used during a digitizing session. The copy must be clearly marked and labeled or mistakes are inevitable. Mistakes may come from using the wrong key on the keypad but most are due to the difficulty in seeing topographic detail along the line of section. The marking of the hard copy will probably take more time than the actual digitizing, but save time in completing the job. There is a 500 point limit to the number of points that can be digitized into a single section. Plan accordingly. Digitize longer sections in pieces.

#### Line of section:

1. Draw the line of section to be followed on the original, or on a transparent overlay. Clearly mark both ends and label with their elevation.

#### Topography:

2. Mark all inflection points (points of known elevation not on contours), and label with their elevation. Intersections of profiles with ridge crests and drainages are obvious places where additional elevation points will improve the quality of the final section by adding interpolated topographic detail.
3. Follow the line of section with a magnifier and make sure that the intersections of the line of section with all of the contours are clear.
4. Check to see that all contour lines are present. In areas of high relief some might have been omitted (editorial deletions for clarity); if the line of section goes through a label on a contour, draw in any missing part of the line.
5. If the direction of slope is not entirely clear, mark contours so that you will know if the elevation is increasing, remaining the same, or decreasing in the direction of digitizing (left to right) along the line of section.

#### Geology:

6. Label all places where marks are wanted on the section: faults, contacts, etc. A careful marking of the hard copy does many things, not the least of which is familiarizing you with details of topography and geology along the line of section. One system of marking uses red line to indicate increasing elevation, green for the same elevation, blue for decreasing elevations, black elevation numbers for points of inflection, and black checks for marker points.

## OPERATING GSSECT

The topographic map with line of section plainly marked and annotated should be firmly fastened to the digitizer table. The computer, digitizer and plotter should be turned on. Operation of the program is simple, but requires **undivided attention** during digitizing. Disconnect the telephone and lock the door.

We strongly advise use of a magnifier during digitizing. The data points may be very close together.

Check to see that the digitizer and computer are ready. Then start the GSSECT program by entering the name of the program. Type **GSSECT**, then strike the enter key. The disclaimer screen will be displayed first. Then after hitting a key, the Main Menu screen will be displayed.

### MENU GSSECT

#### G S S E C T

#### CURRENT SECTION:

- 1 - START A NEW SECTION
- 2 - OPEN AN EXISTING SECTION
- 3 - DIGITIZE PROFILE AND CONTACTS
- 4 - LIST SECTION VALUES
- 5 - PLOT SECTION ON THE HARD COPY PLOTTER
- 6 - SAVE SECTION TO A GSMAP (Cartesian) DATA BASE
- 7 - EXIT

#### ENTER CHOICE BY NUMBER:

#### Option 1, Start a new section

Enter 1 from the menu to start the process of creating a new section. The prompt on screen will request entry of a name for this section:

ENTER FILENAME OF SECTION: CLIMAX

Entry of the section name will bring a prompt asking for map scale unless the section name has already been used: If this is the case, a prompt will be displayed:

A FILE WITH THE SAME NAME ALREADY EXISTS  
DO YOU WANT TO CONTINUE?(Y/N): Y

A "Y" answer will overwrite the older file, a "N" answer will prompt another call for a section name.

Entry of a satisfactory section name (eight characters or less, no extension) brings a prompt asking for entry of the map scale:

ENTER MAP SCALE(i.e. 24000):

Entry of scale (e.g. 24000)B returns the system to the main menu screen.

### Option 2, Open an existing section

Entering 2 from the menu will call a request for the name of the existing section to be used. Such a request will usually be made so that additional plots can be made. No provision has been made for entry of new data once a section has been completed.

ENTER NAME OF SECTION:

After entry of the name of the section, not including the extension (.SEC is required), operations will return to the menu screen.

### Option 3, Digitize profile and contacts

Entering 3 from the menu will start the process of entering data for the new section. Follow the directions on the screen:

ENTER ELEVATION OF STARTING POINT: 12060 (Keyboard entry)

ENTER CONTOUR INTERVAL: 40 (Keyboard entry)

ENTER 0(ZERO) KEY ON CURSOR KEYPAD TO SYNCHRONIZE DIGITIZER INPUT:

The "0" key on the keypad of the digitizer must be pressed. Sometimes this process must be repeated: watch the prompts on the screen. This process synchronizes the digitizer and the computer. After the digitizer and computer have been synchronized, the screen will clear, and the message printed below will be displayed.

|                             |       |
|-----------------------------|-------|
| START SECTION----->         | 0 KEY |
| POINTS ON LINE----->        | 0 KEY |
| HIGHER CONTOUR----->        | 1 KEY |
| SAME CONTOUR----->          | 2 KEY |
| LOWER CONTOUR----->         | 3 KEY |
| INFLECTION POINT----->      | 4 KEY |
| MARK LOCATION----->         | 5 KEY |
| END SECTION----->           | 6 KEY |
| BACKUP TO PREVIOUS POINT--- | B KEY |

These instructions about the functions of the keys on the keypad of the digitizer serve as a reminder during digitizing. The line above the box on the screen will show the key pressed, and the contour level. The contour level of the last point serves as a reminder to guide selection of the proper key for the next point.

**0 KEY**

Begin digitizing with the 0 key at the left end of the section.

After digitizing the first point, the bottom line of the screen will show the key used Y=0, the contour level, and the starting elevation, e.g. Y=0 CONTOUR LEVEL 1200 ST ELEV=1200. If the elevation of the first point is not a possible contour value, the contour level that will be set is the elevation of the contour just below the elevation entered. Subsequent points digitized with the "0" key will be entered as points along the section. No elevation will be entered; the contour level in effect will not change.

### 1 KEY

Points entered using the one key will have a contour level one contour interval higher than that of the previous point.

### 2 KEY

Points entered using the two key will have the same contour level as the previous point.

### 3 KEY

Points entered using the three key will have an elevation one contour interval lower than that of the previous point.

### 4 KEY

The term "inflection point" is used here for a point of known elevation that you wish to add to the section. It is entered using the four key. After hitting the 4 key, the elevation of this point is entered on the keypad of the digitizer. If this elevation is less than 6 digits, the A key is used to "complete" entry of the elevation. After entering a point using the 4 key, the last line of the screen will show the key used (KEY = 4), the elevation of the inflection point and the contour level.

### 5 KEY

The 5 key is used to enter a point that you wish marked, like a point where a fault crosses the plane of section. A short vertical line above the topographic profile will be drawn on plots to mark these points.

### 6 KEY

The 6 key is used to enter the last point (right end) of the section.

Digitizing along the profile proceeds from left to right, with keys used as specified in the on-screen message and described here. During digitizing of the topographic profile, a tone will sound at the entry of each point; there will be two tones for each point where the section crosses a contour; the second of these tones will be higher in pitch for elevations ending in "00" to help the user keep on track, and reduce the chance for error.

### B KEY

The B key is the backup key. It is used to correct mistakes during digitizing. During the digitizing of a section, tapping the B key will back the program ONE point. After hitting the B key the last line of the screen will show data for the last recorded point in the section: this helps you identify the "last" point. To delete this point tap the B key again. The parameters of the previous point will be shown at the bottom of the screen. More points can be deleted if desired by hitting the B key. The bottom line of the screen will change to show the parameters of the last recorded point in the section. Digitizing can continue from that point when all undesired points have been deleted.

### E KEY

If you wish to escape to the Menu screen without completing the section, hitting the E key will return operations to the Menu. The section will not be useful, but the digitizing of a new section can be quickly started.

### Ending the section

Following entry of the end of the section using the 6 key, a prompt will be displayed on the screen requesting entry of the elevation of the end of the section from the keyboard:

ENTER ELEVATION OF LAST POINT1460 (Keyboard entry)

After this entry the screen will clear and the program will return to the Main Menu.

Labels on the digitizer keypad, such as those on the figure on the next page will help with the use of the different keys during digitizing. If you cut the keys out of the drawing below and trim to fit the keypad, the resulting template can be placed on the keypad of a GTCO DIGI-PAD digitizer.



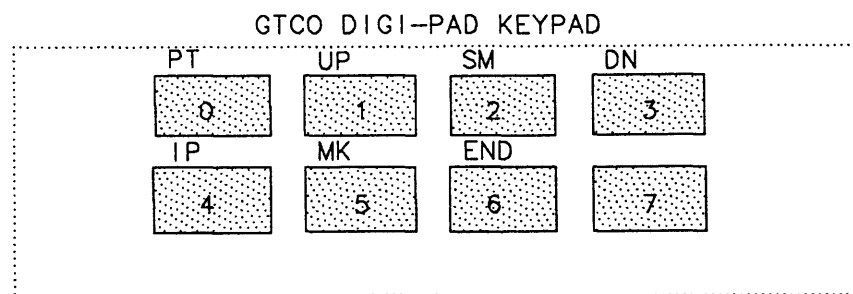


Figure 17. Keypad template to label functions of keys (GSSECT) for the GTCO DIGI-PAD 16 button keypad.

#### Option 4, List section values on printer

Entry of a 4 from the menu will obtain a listing of data for the section. Prompts will request the following entries:  
SCREEN OR PRINTER(S/P):

Enter S for screen display, P for printout on printer. The listing of data for the section, will be supplied in the format shown below. The name of the file will be shown, then the map scale, then the data for profile points, then the data for "Contact" points; the points marked during digitizing.

For points where the elevation was entered during digitizing, the cumulative distance along the line of section from the first point (in inches), the elevation, and the gradient between the point and the preceding point will be provided. The program assumes that the elevations are in feet when calculating gradients.

For "Contact" points, the points marked during digitizing, the elevation shown will be the elevation calculated for this point along the line of section, based on the positions and elevations of the preceding and following points where elevation data was entered. No gradient for "Contact" points will be calculated.

If data for the section is displayed on the screen, the display will pause at 20 line intervals. Touching any key, as prompted will continue the display. An example is provided below.

SECTION FILENAME= BPASS.SEC

MAP SCALE = 24000

##### PROFILE DATA

|       |       |      |       |
|-------|-------|------|-------|
| PT,   | 0.000 | 9600 | 0.00  |
| PT,   | 0.079 | 9560 | -2.11 |
| PT,   | 1.094 | 9280 | -4.50 |
| ..... |       |      |       |
| PT,   | 1.131 | 9240 | -4.50 |

##### FORMAT OF DATA

|     |                        |           |                              |
|-----|------------------------|-----------|------------------------------|
| PT, | 1.169                  | 9200      | -4.39                        |
|     | Distance along section | Elevation | Gradient in % rounded to .XX |

|       |       |      |      |
|-------|-------|------|------|
| ..... |       |      |      |
| PT,   | 1.584 | 9240 | 4.27 |
| PT,   | 1.621 | 9280 | 4.50 |
| PT,   | 2.202 | 9640 | 2.45 |

##### CONTACT DATA

|     |       |      |
|-----|-------|------|
| PT, | 0.222 | 9486 |
| PT, | 0.361 | 9440 |

## Option 5, Plot on the hard copy plotter

Entry of a 5 from the menu starts the process of obtaining a plot of the section.

ENTER BASE ELEVATION, TOP ELEVATION: 9000, 13000  
ENTER HORIZ SCALE, VERT SCALE, TICK INTERVAL: 1, 2000, 400  
ENTER XOFF, YOFF: 1, 1  
ROTATE?(Y/N) N  
ENTER PEN, SPEED, FORCE: 1, 25, 1

These BASE and TOP elevations refer to the elevations of the bottom and top of the end lines of the drafted section. These elevations will be posted close to the right end of the section.

The HORIZ SCALE (HORIZONTAL SCALE) is input as a factor, e.g. "SCALE=1" would plot data digitized from a 1:24,000 scale map at map scale, a "SCALE=2" would plot the same data at twice the length.

The VERT SCALE (VERTICAL SCALE) is entered as the number of feet per inch. (A 1:1 (vertical=horizontal scale) plot from a 1:24,000 scale map would require entry of  $2000 = 24,000/12$ ).

The TICK INTERVAL entered specifies the vertical distance in feet between tick marks on the beginning and end lines of section.

The XOFF, YOFF requested are "offsets", designed to move the plot of the section to a new place on the plotting medium. The desired offset in X and in Y are entered in inches and decimal inches to position the section. A positive X value moves the plot to the right, a positive Y value moves the plot up.

In the example above, digitized from a 1:24,000 scale map, the section will be drawn at 1:1 (no vertical exaggeration, with marks at the ends of the section 400 feet (at 2,000 feet/inch) apart.

ROTATE?(Y/N) N

"ROTATE" A "Y" or "N" answer is needed, and sets the plotter X and Y axes relative to the plot; the default value is N. Check the plotter manual and p.333 for rotation instructions.

ENTER PEN, SPEED, FORCE: e.g. 1, 25, 1

- "PEN" Specify the number of the pen to be used (position in the carousel).
- "SPEED" Specify the speed in cm/sec to be used.
- "FORCE" Specify pen force (a number from 1 to 8, sets pen force (see p. 333 for values).

After entry of PEN, SPEED, FORCE, a prompt will be displayed:  
ONLINE PLOTTER OR DISK(P,d)?:

Entry of "P or D" brings the prompt:  
DO YOU WANT TO POST GRADIENTS ALONG PROFILE (Y/N):

Entry of Y causes the computed gradients between points of known elevation to be posted in their proper position along the line of section (above the end of the segment). Gradients are plotted in percent (trimmed, rather than rounded off). The next prompt asks:  
ENTER WIDTH AND HEIGHT OF POSTING CHARACTERS: This entry specifies the size of the numbers that will be drawn in inches; numbers like 0.04, 0.06 are about as small as legibility permits. After this entry a message will remind; PLOTTER MUST BE TURNED ON AND PAPER LOADED !!!!

After this entry and message, the plotter will start drawing the section.

If D was entered in response to the prompt:  
ONLINE PLOTTER OR DISK(P,d)?:

This entry will bring a prompt asking for the name of the file to be used as an output file. Enter the name of a file with extension:

The next prompt will ask for entry of scaling points:  
P1X,P1Y,P2X,P2Y:

Scaling points are entered as numerical values, e.g. 80,320,10080,7520; the values depend on the plotter and on the size of the sheet to be used for plotting the file. See plotter documentation, and p. 333. Enter the values for these points, , and the program will generate a file written in HPGL.

#### Option 6, Save section to a GSMAP data base

This option permits generation of a GSMAP data base (Cartesian coordinates) from the file generated by GSSECT. Entry of a 6 from the menu will bring prompts as described.

ENTER BASE ELEVATION,TOP ELEVATION: 9000,10400  
ENTER HORIZ SCALE,VERT SCALE,TICK INTERVAL: 1,2000,400  
ENTER XOFF,YOFF: 1,1  
DO YOU WANT TO POST GRADIENTS ALONG PROFILE?(Y/N): e.g N  
ENTER DATABASE NAME:DATABASE  
ENTER TITLE:TITLE

CODE 91 will be used for the vertical and horizontal lines that frame the section.

CODE 92 will be used for the tick marks along the sides of the section.

CODE 93 will be used for the vertical tick marks that mark the intersections of the profile with contacts or other features.

CODE 94 will be used for the topographic profile.

CODE 192 will be used for the posting of the elevation of the base and top of the right side frame; the elevations are recorded as P1, P2 is set to 0.

CODE 194 will be used for the gradient posting; the gradient, trimmed to the nearest percent will be recorded as P1, P2 will be set to 90 (for vertical posting). These points will be entered only if gradients are plotted when first drawing the section.

If a section is to be used to generate a GSMAP data base, an offset such as 1,1 (one inch in both X and Y should be entered to provide space needed for plotting of all parts of the diagram, especially the tick marks on the left end of the section, and the vertical elevation numbers which may be required later.

Files containing the GSMAP data base will bear the data base name entered; extensions required for the two files will be supplied by the program. For a discussion of data base names, titles and plotting of values recorded as P1, and the usage of P2 to set plot angles, codes 100-199, see GSMAP documentation.

#### Option 7, Exit

Entry of a 7 from the menu will return the system to the DOS prompt.

### Sample section

The sections in the next two figures are examples of the output from the GSSECT program. Geologic information can be easily added to the section in digital form using GSMAP to generate complete and finished copy for publication. Gradients were plotted on the lower section, the upper provides the elements needed before addition of geologic interpretation.

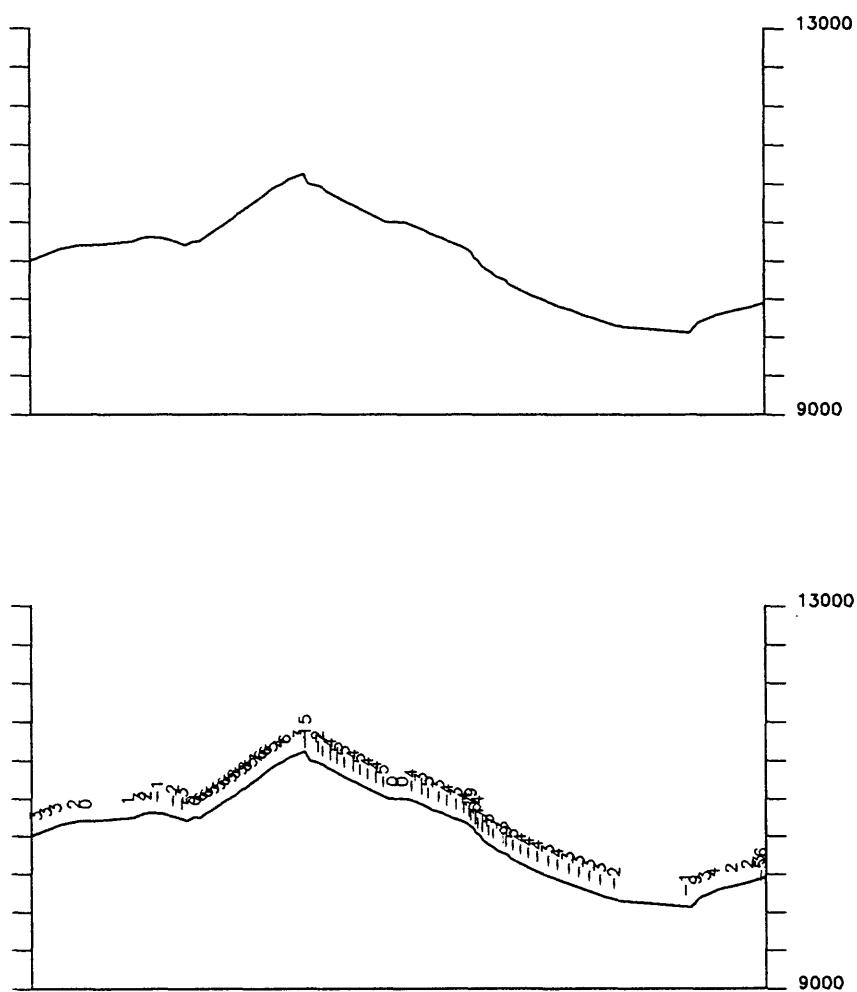


Figure 18. Topographic profiles prepared using GSSECT

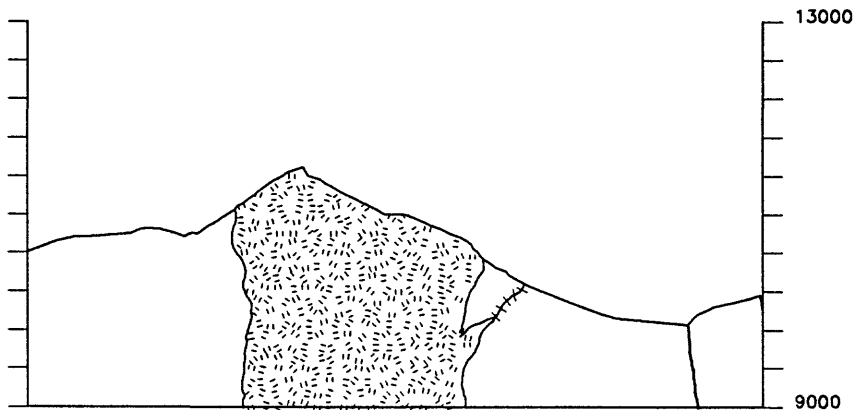


Figure 19. GSSECT topographic profile, section augmented using GSMAP.

## COMBSECT

The utility program COMBSECT.EXE adds one section to the end of another section. It allows, for example, the separate digitizing of the two parts of a section on a dog-leg trace, and the drawing of a single section from the combined result. Digitizing and checking of a long section may be most easily done in several segments. When using this program enter the full file names (with extension).

To use the program, enter COMBSECT. A prompt will request entry of the file name for a section:

ENTER FILENAME OF SECTION(CR TO STOP): Enter the name of the first section (left side of the combined section).

After entry, this prompt will be repeated. Respond, and enter the name of the section to be added. After this entry the prompt will be repeated. Use of the carriage return (CR) at this prompt will terminate the process of specifying sections to be combined and bring a request for the name of the output file for the combined section; use the SEC extension.

ENTER FILENAME FOR OUTPUT FILE:

After entry of the FILENAME, The program will run. When it has finished operation, the system will return to the DOS prompt.

The COMBSEC program will compare the elevations of the last point of the first section and the first point of the second, and provide a warning on the screen if they are different. The elevation of the last point of the first section will be used in the combined output file. Section (.SEC) files are ASCII files and can be edited using a word processing program.

## CHAPTER 6

Chapter 6 contains descriptions of a series of programs that create, modify, or make use of data in row column ASCII files, in the format described here as the GSPOST format.

GSDIG is used to digitize point locations from maps, and provides either latitude and longitude values or X Y values in a coordinate system chosen by the user.

GSPOST draws data from a GSPOST format file, draws plots on the screen, on a plotter, or writes to a disk file in HPGL to make maps displaying information associated with geographic sites by drawing symbols and/or posting numerical data. GSPOST selects symbols according to values in a data column as specified in a plot control file, and can post numerical value in a default position, in alternate positions, and at selected angles to reduce over-posting. Its on-screen display assists analysis and editing.

GSPUTIL is a utility program with options that provide conversion of the location coordinates of GSPOST files from one coordinate type to a different type, sort GSPOST files into geographic blocks to reduce plotting time, and select data points either inside or outside areas defined in ASCII trim files.

Graphical and statistical support is provided by four programs.

GSPUV calculates univariate statistics parameters and generates histograms from data drawn from a selected column.

GSPPROB generates probability diagrams drawing data from a single column.

GSPXY constructs X,Y plots from two selected columns and provides regression coefficients.

GSPTD generates a ternary diagram using data from three selected columns.

These four programs can draw data from GSPOST files in geodetic DD or DMS format, Cartesian format, or in row-column files without coordinates. These N format files have an identifier in the left column, then up to 50 columns for data on the right of the identifier column; no location, alternate location, or rotation columns are permitted in this type of file.

### Graphic Sections

GSPCS will produce graphic sections from data in selected columns.

### Contouring and gridding

GSPDC provides contouring and gridding of data from one data column based on generation of Delaunay triangles.

## GSPOST DATA FILES

The GSPOST format data file is an ASCII data file that contains a series of rows and columns. Each data row (record or line) is a series of entries that apply to one data point. Each column contains one kind of attribute. Examples are printed, p.159, 160. The number of records in theory is unlimited. In practice, some programs limit the number of records that can be supported. These limits are indicated in the descriptions of the programs. This version of GSPOST has not been tested with files that contain more than 560,000 rows.

### Header records

The first line of the file must contain information about the file. In sequence, the number of data rows, the number of columns, the number of lines of text between line 1 and the first data record, and characters that specify the format of the file. These characters must be selected from the following: GDD=geodetic, degrees latitude, degrees longitude; GDMS=geodetic degrees minutes seconds compass direction latitude, degrees minutes seconds compass direction longitude, C=Cartesian, or N=No coordinates (no alternate posting positions, no rotation angle).

Additional header records (lines) below line 1 can be used to provide information about the file. If a blank line follows the last line in the file that contains data, annotations can be made to the end of the file.

### Control columns

The first several columns in the data file contain the site's identifier, two for the site's coordinates, and the plot angle for posted values, and two for alternate posting positions. The succeeding columns are data columns; the user can choose the attributes to be displayed. Examples of geochemical attributes might include the concentrations of silver, copper, and lead. All attributes in data columns must be numbers.

Column 1 must be used for the locality identifier (the locality number or alphanumeric label for the data point). This identification label can consist of up to 15 alphanumeric characters or numbers, but must not include a comma. These characters or numbers must be followed by a comma to end the string of characters that constitutes the locality identifier. If the locality identifier is enclosed in quotation marks the comma is not required. A blank space after the comma is permitted, but isn't required.

The next columns contain the coordinates of the site. Two formats are acceptable for geodetic coordinates.

Format: Decimal degrees:  
DD.DDDD,DDD.DDDD    Latitude, then Longitude

Latitude and longitude values using this format can be positive or negative. Latitude values are positive in the northern hemisphere and negative in the southern hemisphere; longitude values are positive in the eastern hemisphere and negative in the western hemisphere.

Format: Degrees, minutes, and seconds:  
DD,MM,SS.SS,C,DDD,MM,SS.SSS,C, Latitude, then Longitude

The character represented by C above may be N,S,E,W as appropriate to provide the required compass direction for North or South latitudes and East or West longitudes.

Format, Cartesian coordinates:  
X,Y

X and Y coordinates are specified in decimal units defined for each plot. Scales must be selected to match the units and the desired plot size as if the units were in plot inches.



### Posting angle

The column following the last coordinate column is used for a number, best understood as an "angle", which specifies rotation of posting about the data point. We recommend starting with a series of zeros in this column, then, if necessary, edit the column using the screen-editor to rotate postings to positions that avoid overwriting of values.

Entry of an angle of 0 specifies a posting to the right of the symbol. An angle of 180 degrees specifies posting left of the symbol. Other angles cause rotation of the posting to other positions; positive angles are measured counterclockwise from the horizontal; negative angles can be used.

### Alternate posting positions

The fifth and sixth or the eleventh and twelfth columns are used to specify alternate positions for posting data. These columns are modified when the on-screen edit capabilities of GSPOST are used to generate alternate positions. Values of 0 for these alternate positions cause default to the site locations. To begin work with a file, we suggest that posting angles and alternate positions be specified as 0. Entries in the data file would appear as shown in examples that follow.

### Data columns

The ASCII data file can have up to 50 data columns. The "control" columns must be reserved for the specific uses described above. The next fifty columns are data columns that can be used for numerical data (numbers only, no alpha characters).

The ASCII data file can be created in a variety of different ways. If data is available in LOTUS 1,2,3 or similar program, a data file can be created by asking for generation of a PRN file. Regardless of how the ASCII data file is generated the user must make certain that a comma is present after the locality identifier or that it is enclosed by double quote marks (" "), that any column containing an alpha character ends with a comma, that other columns are separated by a "blank" and that data columns contain numbers only. The user specifies (and must keep track of) the data types in each column by number. The data columns are counted from the left. Data column #1 follows the column that contains the longitude value for the alternate posting position (or the zero that specifies the default position).

# Examples of ASCII data files for GSPOST

The example of a geodetic data file provided below contains latitude, longitude data in decimal degrees, has no header lines, and no entries below the last record.

8,4,0,GDD

|          |          |          |       |      |    |    |    |
|----------|----------|----------|-------|------|----|----|----|
| IFAA001, | 43.987   | -113.768 | 0 0 0 | 943  | 6  | 65 | 28 |
| IFAA002, | 43.9875  | -113.816 | 0 0 0 | 1007 | 7  | 85 | 24 |
| IFAA004, | 43.9709  | -113.883 | 0 0 0 | 935  | 11 | 58 | 29 |
| IFAA005, | 43.96049 | -113.888 | 0 0 0 | 884  | 6  | 69 | 32 |
| IFAA006, | 43.95979 | -113.855 | 0 0 0 | 911  | 6  | 60 | 23 |
| IFAA008, | 43.92329 | -113.863 | 0 0 0 | 911  | 10 | 49 | 30 |
| IFAA009, | 43.96471 | -113.763 | 0 0 0 | 1114 | 11 | 76 | 27 |
| IFAA010, | 43.94881 | -113.801 | 0 0 0 | 1082 | 8  | 60 | 25 |

The example of a geodetic data file provided below contains latitude, longitude in degrees, minutes, and seconds is provided below. It has one header record, and no entries below the last record.

8,4,1,GDMS

| Identifier |    |    |       |     |    |       |       |      | Fe | Ti | Mn | P205 |
|------------|----|----|-------|-----|----|-------|-------|------|----|----|----|------|
| IFAA001,   | 43 | 59 | 13 N, | 113 | 46 | 5 W,  | 0 0 0 | 943  | 6  | 65 | 28 |      |
| IFAA002,   | 43 | 59 | 15 N, | 113 | 48 | 58 W, | 0 0 0 | 1007 | 7  | 85 | 24 |      |
| IFAA004,   | 43 | 58 | 15 N, | 113 | 52 | 59 W, | 0 0 0 | 935  | 11 | 58 | 29 |      |
| IFAA005,   | 43 | 57 | 38 N, | 113 | 53 | 17 W, | 0 0 0 | 884  | 6  | 69 | 32 |      |
| IFAA006,   | 43 | 57 | 35 N, | 113 | 51 | 18 W, | 0 0 0 | 911  | 6  | 60 | 23 |      |
| IFAA008,   | 43 | 55 | 24 N, | 113 | 51 | 47 W, | 0 0 0 | 911  | 10 | 49 | 30 |      |
| IFAA009,   | 43 | 57 | 53 N, | 113 | 45 | 47 W, | 0 0 0 | 1114 | 11 | 76 | 27 |      |
| IFAA010,   | 43 | 56 | 56 N, | 113 | 48 | 4 W,  | 0 0 0 | 1082 | 8  | 60 | 25 |      |

The example of a Cartesian coordinate data file provided below has no header records, and no records following the last data record.

7,4,0,C

|          |        |         |       |      |    |    |    |
|----------|--------|---------|-------|------|----|----|----|
| TRAA001, | 43.98  | 113.768 | 0 0 0 | 943  | 6  | 65 | 28 |
| TRAA002, | 43.987 | 113.81  | 0 0 0 | 1007 | 7  | 85 | 24 |
| TRAA005, | 43.960 | 113.88  | 0 0 0 | 884  | 6  | 69 | 32 |
| TRAA006, | 43.959 | 113.85  | 0 0 0 | 911  | 6  | 60 | 23 |
| TRAA008, | 43.923 | 113.86  | 0 0 0 | 911  | 10 | 49 | 30 |
| TRAA009, | 43.964 | 113.76  | 0 0 0 | 1114 | 11 | 76 | 27 |
| TRAA010, | 43.948 | 113.80  | 0 0 0 | 1082 | 8  | 60 | 25 |

Commas must be used after the identifier and after the characters used to designate the "Compass" directions. Commas or blanks can be used to separate any of the other columns.

# Example of an edited geodetic coordinate data file

The example of an edited Geodetic coordinate data file provided below has three header records, and no records following the last data record. Posting angles modified during editing are printed in bold type; the latitude and longitude values for alternate posting positions are underlined. Only a part of the file has been printed so that the print will fit on the page. Alternate posting positions are recorded in decimal degrees. Zeros are introduced when the fixed format of the output data file is imposed.

"Samples analyzed using an A-Z technique on the ICP"

19,12,1,GDD

| "SAMPID" | "Lat"      | "Long"     | "Ang"      | ALT LAT         | ALT LONG          | "SampT"  | "Ag"    | "As"      |
|----------|------------|------------|------------|-----------------|-------------------|----------|---------|-----------|
| "RT002   | " 38.85561 | -115.76600 | 0          | <u>38.85122</u> | <u>-115.77191</u> | 61.00000 | 0.50600 | 111.63400 |
| "RT005   | " 38.77740 | -115.77000 | 0          | 0.00000         | 0.00000           | 61.00000 | 0.02400 | 5.57700   |
| "RT007   | " 38.80341 | -115.79900 | 0          | 0.00000         | 0.00000           | 61.00000 | 3.14900 | 80.88800  |
| "RT008   | " 38.83220 | -115.83700 | 0          | 0.00000         | 0.00000           | 61.00000 | 0.02400 | 2.76500   |
| "RT009   | " 38.86470 | -115.88500 | <b>180</b> | 0.00000         | 0.00000           | 61.00000 | 0.00800 | 9.60500   |
| "RT010   | " 38.90860 | -115.92100 | 0          | 0.00000         | 0.00000           | 61.00000 | 0.02100 | 3.95300   |
| "RT011   | " 38.91991 | -115.94400 | 0          | 0.00000         | 0.00000           | 61.00000 | 0.10400 | 2.21700   |
| "RT024   | " 38.94521 | -115.86400 | 0          | 0.00000         | 0.00000           | 61.00000 | 0.04000 | 0.00000   |
| "RT031   | " 38.86380 | -115.91400 | 0          | 0.00000         | 0.00000           | 61.00000 | 0.05700 | 18.60000  |
| "RT032   | " 38.85950 | -115.93000 | 0          | <u>38.85448</u> | <u>-115.93464</u> | 61.00000 | 0.06000 | 4.93000   |
| "RT036   | " 38.78680 | -115.96500 | 0          | 0.00000         | 0.00000           | 61.00000 | 0.15500 | 8.35600   |
| "RT038   | " 38.76379 | -115.91600 | 0          | 0.00000         | 0.00000           | 61.00000 | 0.07000 | 9.22200   |

## GSDIG

GSDIG Version 9.0 makes use of a digitizer to determine geodetic (latitude, longitude) coordinates or Cartesian (X, Y) coordinates from maps or drawings and create ASCII character files containing site identifiers and geodetic coordinates (degrees, minutes, seconds) or Cartesian coordinates in units from the drawing or digitizer units (usually inches). Geodetic coordinates for points can be digitized from any map that has latitude/longitude coordinates for four points and has been drawn using one of the supported map projections.

The output format for the ASCII files can be chosen to provide easy input of data to GSPOST, spreadsheet, data base management programs, or to geodetic or Cartesian data bases in GSMAP format.

Alphanumeric site identifiers are in part entered from the computer keyboard computer, in part from the digitizer keypad. One option (option 15) of the utility program GSMUTIL has been included so that digitized geodetic (latitude, longitude) or Cartesian (X,Y) data in one format or can be directly entered into a GSMAP data base. Data from a series of maps can be digitized and the data stored in a single output file in a single digitizing session without leaving the program. Alternatively, data can be added to an existing file permitting use of a single file in several digitizing sessions. Use of a "mask" composed of prefix and suffix entered from the keyboard permits alphanumeric identifiers for sites to be entered from the numeric keypad of the digitizer during digitizing. The prefix, maximum number of digits, and the suffix can be changed during digitizing without reentering the coordinates of the corners of the map, or reindexing the map to the digitizer.

### Functions of keys on the multi-key keypad

#### Numeric Keys

The 0 key is used to synchronize the communication between digitizer and computer and to enter the number zero in the site number.

The 1 key is used to digitize the location of the site and to enter the number one in the site number. The keys 2-9 are used to enter the numbers 2-9 in the site number.

#### Alphabetic keys

Alphabetic keys on the digitizer keypad are used for special functions, not for entering letters.

The A key is used to complete the entry of the number for a site, if it contains fewer digits than the maximum number specified.

The C key is used to ready the system for a change of the site identifier mask at the point in operations when the system is ready to receive a new site number.

The D key is used to end the digitizing session on the current map at the point in operations when the system is ready to receive a new site number.

The E key (Escape) is used to return the system to the point when the site identifier is to be entered, if an incorrect identifier number has been entered.

### Digitizing using a single button cursor and the Menu Template

GSDIG supports use of a single key on the digitizer cursor by using a menu template 2 inches square, see p. 15, digitizer board. Tape the template securely to the digitizer board outside the map area and square the template with the sides of the board (close is good enough). The CONFIG9.DIG file must specify the Menu Template. Any key can be used. The cursor is used with the menu template as a pointing device to enter the site identifier number, change maps, change masks, index the copy to the digitizer table, and to digitize points. The numbered circles on the template substitute for use of the numbered keys on a multi-key keypad.

## GSDIG Geodetic coordinates

During operation of GSDIG to generate geodetic coordinates prompts will call for the user to specify:

1. The name of the map from which information is to be digitized.
2. The type of map, and, depending on the type of map, either the latitude/longitude coordinates of the northwest corner of the map or the latitude/longitude coordinates of the four corners of the map used to index the map to the digitizer.
3. The name for the output file.
4. The contents of an identifier mask, consisting of an alphanumeric prefix, the maximum number of digits in the numerical part of the identifier, and an alphanumeric suffix. The prefix and suffix are entered from the computer keyboard. This procedure provides alphanumeric site identifiers generated from the numeric digitizer keypad. The site numbers are entered from the digitizer keypad.
5. One of three formats. A spreadsheet format that facilitates export to spreadsheet programs, one that can directly be used by GSPOST, and a third "generic" format that provides immediate interface to GS MRDS (Taylor, Selner, and Johnson, 1986) if the generic file has no prefix, a 5 digit identifier, and no suffix.

Projection files may be required for digitizing latitude, longitude coordinates. If sites on maps in the conterminous US belonging to one of the four common quadrangle map series (7.5 by 7.5 minute maps, 15 by 15 minute maps, 30 minute by 1 degree maps, or 1 degree by 2 degree maps) are to be digitized, only the latitude-longitude of the northwest corner of the map must be entered. The computer will generate the latitude/longitude values for the three other corners required by the program. Projection files are not required for these maps. The Universal Transverse Mercator will be used by default. A projection file is not required for the following standard USGS and AMS series of quadrangle maps, **IF the map is in the northwest quadrant of the Earth (N longitude, W Longitude), and the corners used to index the map to the digitizer table are the corners of the map..**

1. 1:24000 7.5 minutes by 7.5 minutes
2. 1:62500 15 minutes by 15 minutes
3. 1:10000 30 minutes by 1 degree
4. 1:250000 1 degree by 2 degrees

For maps not meeting the above criteria or maps in other quadrants of the world, an external projection file appropriate for the map is required. This file must be created before starting the GSDIG program, see pages 307-312 for details. Latitude, longitude values for sites can be digitized from other maps if they use one of the supported map projections: Universal Transverse Mercator, Transverse Mercator, Lambert Conformal Conic, Albers Equal Area, Mercator, Oblique Mercator, Polyconic, and Equidistant Conic. For maps other than the examples 1-4 above, projection files, and the latitude, longitude coordinates of four points (corners for purposes of digitizing) must be entered. Samples of projection files are included on the release disk as files with the extension PRJ.

## GSDIG Cartesian coordinates

During operation of GSDIG to generate Cartesian coordinates prompts will call for the user to specify:

1. The name of the map from which information is to be digitized.
2. The coordinates of the corners of the map.
3. The name for the output file.
4. The contents of an identifier mask, consisting of an alphanumeric prefix, the maximum number of digits in the numerical part of the identifier, and an alphanumeric suffix. The prefix and suffix are entered from the computer keyboard. This procedure provides alphanumeric site identifiers generated from the numeric digitizer keypad. The site numbers are entered from the digitizer keypad.
5. One of three formats. A spreadsheet format that facilitates export to spreadsheet programs, a generic format, and a GSPOST format that can be used directly by the GSPOST program or used by Option 15 of the GSMUTIL program to generate a GSMAP data base.

The prompt that calls for entry of the coordinates of the hard copy permits entry of the Cartesian coordinates of the reference corners in four ways:

1. ALL FOUR CORNERS from the digitizer.
2. SPECIFY UPPER RIGHT CORNER (X,Y) from the keyboard.
3. SPECIFY LOWER LEFT (X,Y), UPPER RIGHT (X,Y) from the keyboard.
4. ALL FOUR CORNERS (X,Y) from the keyboard.

The coordinates that result from the above are as follows:

1. Coordinates are established from the digitizer, in digitizer units (generally inches). The LL (lower left) is assigned coordinates  $X=0, Y=0$ , the UL (upper left, coordinates  $X=0, Y$  (Y is measured by the digitizer). Coordinates of the LR (lower right) and UR (upper right) corner are as measured from the digitizer, with the Y axis established by the two left corner points, and the X axis perpendicular to Y. Digitizer units (generally inches) are used.
2. Corner coordinates are established from the computer keyboard. If coordinates  $X_b, Y_b$  are entered for the upper right corner, four corners of a rectangular map are set as follows:  
 $UL = 0, Y_b, LL = 0, 0, LR = X_b, 0, UR = X_b, Y_b$ .
3. Coordinates are established from the computer keyboard. If coordinates are entered for the lower left corner  $X_a, Y_a$  and the upper right corner  $X_b, Y_b$ , the four corners of a rectangular map are set at:  
 $UL = X_a, Y_b, LL = X_a, Y_a, LR = X_b, Y_a, UR = X_b, Y_b$ .
4. Coordinates are specified for all four corners from the computer keyboard.

If 2, 3, or 4 (above) are used for input of corner coordinates the scale in Y is set from the distance between the LL and UL corners, the scale in X from the distance between the LL and LR corner.

## Operating GSDIG

The program file GSDIG.EXE, must be in an active directory, the CONFIG9.DIG and CONFIG9.SCR files in the active directory or as specified by the environmental variable.

GSDIG is started by entering GSDIG at the DOS prompt. A disclaimer screen will be briefly displayed, and then the program will enter an interactive mode with screen prompts. Selection of a coordinate system is first required. The first prompt is:

DO YOU WANT TO WORK WITH GEODETIC OR CARTESIAN COORDINATES?(G/C):

Enter G if you wish latitude/longitude coordinates, enter C if you are working with Cartesian (X,Y) coordinates).

Selection of Output format:

The screen provides a listing of the formats for the output files that can be selected. Examples are provided in the section on output files, p. 169, 170. The prompt will be:

THERE ARE THREE OUTPUT FORMATS AVAILABLE:

1 - GENERIC

2 - SPREADSHEET STYLE FORMAT

3 - GSPOST STYLE

ENTER DESIRED FORMAT (1,2,3):

The generic format creates a file in which each record, one for each site, contains the site identifier and coordinates for the site in a simple format.

The spreadsheet format creates a file containing the map name, scale and map series, and coordinates of the northwest and southeast corners of the map used for digitizing. Each site record contains the site identifier, latitude, and longitude, with added characters to facilitate import into a spreadsheet program. Records for each map digitized are separated by the characters "\*\*".

The GSPOST format creates a file that can be used by the GSPOST program for immediate plotting of a sample locality map and can be taken into GSMAP using Option 15 of the GSMUTIL program.

Entry of a 1 (Generic format), or 2 (Spreadsheet format, or 3 (GSPOST format) brings a prompt to the screen requesting the name of the file to be used to store the data:

ENTER OUTPUT FILE NAME:

Enter the desired file name with extension (and drive, if other than the default drive). If the name of an existing file is entered the following prompt will be displayed:

A FILE OF THE SAME NAME ALREADY EXISTS

DO YOU WANT TO APPEND TO IT? (Y/n):

If you enter "Y" digitized data will be appended to the end of the pre-existing file. If you answer "N" a new file (with the name that you entered) will be created, and new data put into this file. **WARNING** The old file with the name entered will be written over and its contents lost! The default is Y append.

The next three prompts request information to create a site identifier mask: The identifier mask consists of a prefix (up to 10 characters), the maximum number of digits (a number 1-10) that will be entered from the digitizer's keypad, and a suffix (up to 10 characters). The prefix and the suffix that the user inputs from the computer keyboard will be combined with each of the site numbers the user will enter from the digitizer keypad during digitizing. For example: prefix = GIS, number of digits = 4, suffix = RS would result in site identifiers of the form GIS0001RS. Remember, if you are going to use this file for input to GS MRDS, do not use a prefix or suffix and select 5 digits as the maximum.

The next prompt requests entry of a map name. If commas or other delimiters are used in the map name, the map name should be enclosed within quotation marks (" "). As many as 60 characters can be used in the map name. The map name will not be written into the file generated by the GENER-IC format, so a carriage return should be used as the map name. Entry of "QUIT" at this point returns the system to the DOS prompt.

Changing the site identifier mask:

The next prompt enables a change of site identifier mask. The user must enter either Y (yes) or N (no). The default is N (no); press Enter key.

The next prompt is different for geodetic and for Cartesian coordinate systems. The geodetic requirements are discussed first, then the Cartesian.

#### Geodetic coordinates

Map types: the screen displays a listing of five map types that can be chosen.

1. 24000 7.5 MINUTE
2. 62500 15 MINUTE
3. 100000 30 MIN LAT x 1 DEG LONG
4. 250000 1 DEG LAT x 2 DEG LONG
5. OTHER

ENTER TYPE:

Standard quadrangle series maps

If map type 1, 2, 3 or 4 is selected by entering one of these numbers, the screen will prompt for the latitude and longitude of the northwest corner of the map in degrees, minutes, and seconds. Latitude and Longitude are entered in the form DD,MM,SS,C,DDD,MM,SS,C; Latitude followed by Longitude, all values separated by commas. D stands for degrees, M for minutes, S for seconds, C = N or S for latitude, E or W for longitude. An example might be 34,7,30,N,104,45,15,W. If option 1, 2, 3, or 4 is chosen, the UTM projection is chosen for digitizing by default without requiring preparation of a projection file.

OTHER maps

The "OTHER" map type, number 5, must be used for maps:

- Other than North Latitude and West Longitude
- Other than the four standard quadrangle series stated above using their corner points
- If use of the UTM projection is not appropriate.

Using the "Other" map type requires an already prepared projection file appropriate to the map being used. If the user chooses map type 5, "OTHER", the screen will prompt for the latitude and longitude of each corner of the map; first the northwest, then the southwest, southeast, and northeast in sequence. After entry of values for these corners, a prompt will request entry of the name of the projection file to be used.



## Cartesian coordinates

Prompts will request selection of a method for specifying the corners of the map or diagram to be used for digitizing.

### OPTIONAL METHODS FOR SPECIFYING CORNERS FROM DIGITIZER

1 ALL FOUR CORNERS

### FROM KEYBOARD

2 - SPECIFY UPPER RIGHT CORNER (X,Y)

3 - SPECIFY LOWER LEFT (X,Y), UPPER RIGHT (X,Y)

4 - ALL FOUR CORNERS (X,Y)

Method 1: coordinates are established from the digitizer. Methods 2, 3, and 4. Corner coordinates are established from the computer keyboard. After choosing the method for input of corners, prompts will be shown. If methods 2, 3, or 4 are chosen the screen will prompt for entry of the corner or corners in the form X,Y from the computer keyboard. After specification of corner coordinate values input will be requested from the digitizer keypad. If Method 1 was chosen, prompts will request entries from the digitizer keypad.

## Geodetic and Cartesian coordinates

### Synchronizing the digitizer for keypad digitizers

The screen will prompt the user to press the 0 (zero) key of the digitizer keypad in order to synchronize output from the digitizer to the computer. The keypad can be anywhere within the active area of the digitizer table. This prompt will repeat until the computer and digitizer are synchronized.

### Synchronizing the digitizer and indexing the Menu template

Prompts will ask for entry of the lower left and upper right corners of the Menu template. Move to each in turn and press a key.

## Cartesian coordinates

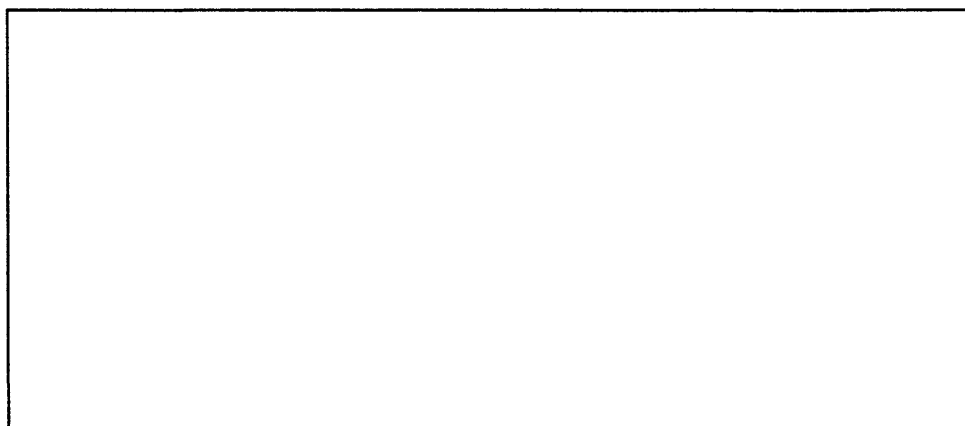
If method 1 of specifying the corners was chosen, the process of entering the map corners establishes the coordinate system. Prompts will ask for entry of the map corners on the digitizer in the following order: upper left, lower left, lower right, and upper right. These map corners must be indexed to the digitizer table by moving the cross hair of the digitizer's cursor to the appropriate corner and pressing the 0 key of the digitizer keypad.

Geodetic and Cartesian coordinates, registering corners of the hard copy to the digitizer table

Prompts will ask for entry of the map corners on the digitizer. In sequence the northwest, southwest, southeast, and northeast corners (geodetic) or upper left, lower left, lower right, upper right (Cartesian) of the map must be indexed by moving the cross hair of the digitizer's cursor to the appropriate corners in turn and pressing the 0 key of the digitizer keypad (or any key if using the Menu template).

#### Verifying the scale

The screen will display the scale in X and the scale in Y, and ask the user if he wishes to continue. A message will warn the user if the X and Y scales differ by more than 2%. If this happens site localities should not be digitized unless unusual circumstances can be clearly established. If the user indicates that the X and Y scales are acceptable and that the program should continue, by entering Y, the computer screen will display a rectangle within which digitized sites will be shown as points, and reminders of the functions of the keys on the cursor of the digitizer. The system at this point is ready for entry of the site identifier and the screen will appear as shown below:



DIG

KEY DEF.

-----

1=SAM. LOC

A=END FLD

C=CH. MASK

D=DONE

E=ERROR

#### ENTER NUMBER ON DIGITIZER

Entering the identifier number.

Enter the site identifier number using the digitizer keypad and pressing the appropriate number key in sequence from left to right (the keypad can be located anywhere within the active area of the table) or by moving the cursor to the appropriate circle of the menu template and pressing a key. If the site number contains fewer than the maximum number of digits specified when creating the identifier mask, the A key should be pressed (or the A circle used) to complete the entry of the identifier number. The complete site identifier will appear at the lower left corner of the screen. If the user enters an incorrect identifier number, the E key can be pressed and the number can then be reentered.

Digitizing site locations

The bottom line on the screen will now prompt:

#### ENTER LOCATION ON DIGITIZER

The cross hairs of the cursor should be positioned precisely at the site to be digitized, and the 1 (one) key pressed. A high pitched tone will sound, and a dot will appear on the screen corresponding to the location digitized.

After digitizing the point, the system is ready for entry of the next site number and the prompt will change to:

## ENTER NUMBER ON DIGITIZER

The cycle of entering numbers and digitizing points thus begins again. Input of site numbers and digitizing of site locations then continues with repetition of prompts as described above until the user wants to either change the site identifier mask or finishes digitizing information on the map.

### Changing the identifier mask.

The user indicates that he wishes to change the identifier mask by entering a **C** instead of entering a site number.

### Terminating digitizing on a map.

The user indicates that he wishes to change to a new map by entering a **D** instead of entering a site number. The program will return to the prompt:

ENTER MAP NAME(QUIT) TO EXIT.

.

Ending a digitizing session.

At the ENTER MAP NAME(QUIT) TO EXIT prompt, enter QUIT from the keyboard of the computer.

## Output Files, geodetic coordinates

The GSDIG program generates an ASCII character file. The name of the file is supplied by the user. The structure of the output file depends on the choices made during the operation of the program.

### Generic format: latitude, longitude coordinates

Each line of the file contains the site identifier number, latitude, and longitude in the format below. The underlined characters in the example below include the prefix, site number, and suffix

GIS00023PS38 32 53.188N104 57 16.486W

GIS00024PS38 32 53.188N104 56 16.476W

If no prefix, suffix, and 5 digits are specified, the resulting file has the exact format required for entry into GS MRDS.

This GSDIG file contains a series of records like the one below. One line is used for each site.

|                                                                      |
|----------------------------------------------------------------------|
| 0002338 32 53.188N104 57 16.486W<br>0002338 32 51.188N104 57 16.476W |
|----------------------------------------------------------------------|

### Spreadsheet format: geodetic coordinates

The first line of the spreadsheet format file is the map name supplied by the user from the computer keyboard, enclosed by quotation marks.

e.g. "Map number one"

The second line records the type of map in quotes.

e.g. " 7 1/2 MINUTE"

The next line provides the latitude-longitude coordinates of the northwest and southeast corners of the map within quotation marks.

e.g. "38 0 0 108 0 0 37 52 30 107 52 30"

Succeeding lines of the file contain information about the site identification number and the latitude/longitude of the site. The first entry on each line is a quoted asterisk, the next is the site identification number combined with the user supplied prefix and suffix, enclosed within quotation marks. These are followed by the latitude and longitude of the site.

One line is used for each site.

e.g.

|                   |                              |
|-------------------|------------------------------|
| *** "RBT00001-90" | 40 44 29.921N 105 36 36.682W |
| *** "GIS001EX"    | 37 57 24.474N 107 54 54.877W |
| *** "GIS013EX"    | 37 56 13.839N 107 54 32.430W |
| *** "KRG035TX"    | 37 53 53.492N 107 54 6.8263W |
| ***               |                              |

The final record (line in the file) for each map is a quoted asterisk "\*\*\*". If sites from several maps were digitized in the same session, similar records for each map and site will be created.

### GSPOST format, geodetic coordinates

Each line of the file contains the site identifier, latitude, longitude, and three trailing 0's as required by the GSPOST program, as in the example printed below.

|                                                     |
|-----------------------------------------------------|
| RBT-00001-91, 39 54 23.504 N, 106 10 7.688 W, 0 0 0 |
| RBT-00002-91, 39 50 1.495 N, 106 9 59.857 W, 0 0 0  |
| RBT-00003-91, 39 55 0.981 N, 106 5 0.275 W, 0 0 0   |

### Output Files, Cartesian coordinates

#### Generic format: Cartesian coordinates

Sample file, Generic format. Prefix **RBT-**, 5 digits, **-88** suffix.

|              |         |         |
|--------------|---------|---------|
| RBT-00100-88 | 199.729 | 999.838 |
| RBT-00102-88 | 219.233 | 979.343 |
| RBT-00104-88 | 299.865 | 699.799 |
| RBT-00105-88 | 599.734 | 498.862 |

#### Spread sheet format: Cartesian coordinates

The first line of the file is the map name supplied by the user from the computer keyboard, enclosed within quotation marks.

e.g. "Map number one"

The second line records the coordinates of the northwest and southeast corners of the map within quotation marks.

e.g. "100.00 105.555 125.00 110.00"

Succeeding lines of the file contain information about the site identification number and the X, Y coordinates of the site. The first entry on each line is a quoted asterisk, the next is the site identification number combined with the user supplied prefix and suffix, enclosed within quotation marks. These are followed by the X and Y coordinates of the site.

One line is used for each site, e.g.

\*\*\* "RBT-00110-88" 3.991 2.985

The final record (line in the file) for each map is a quoted asterisk, e.g.,

\*\*\*

If sites from several maps were digitized in the same session, similar records for each map and site will be created. The example below is a file created using the spreadsheet format, digitizing from a map named Lmap, prefix RBT, 5 digits, suffix 88, corners specified using method 3.

|                                                  |
|--------------------------------------------------|
| "Lmap"                                           |
| " 3 - SPECIFY LOWER LEFT(X,Y), UPPER RIGHT(X,Y)" |
| " 100 1100 800 100 "                             |
| *****RBT0012088" 300.247 999.458                 |
| *****RBT0012288" 400.342 824.389                 |
| *****RBT1234588" 517.428 665.942                 |
| *****                                            |

### GSPOST format, Cartesian coordinates

Each line of the file contains the site identifier, X coordinate, Y coordinate, and three trailing 0's as required by the GSPOST program, as shown in the example below.

|               |       |        |   |   |   |
|---------------|-------|--------|---|---|---|
| RBT-00001-91, | 4.397 | 11.614 | 0 | 0 | 0 |
| RBT-00002-91, | 4.500 | 5.820  | 0 | 0 | 0 |
| RBT-00003-91, | 8.955 | 10.904 | 0 | 0 | 0 |

Use of USMUTIL Option 15 to create a GSMAP data base from a GSPOST file format is discussed p. 159, 160. We remind you here that you should specify **GDMS** as the format for the GSPOST file created by GSDIG in response to one of the prompts, as the degree, minute, second, compass direction format is used.

Before using a GSPOST format file created in GSDIG you must determine the number of rows in the file, number of data columns, text lines, and data format and add a first line for the file using a text editing program, e.g. **23,0,0,GDMS**.

An unmodified GSPOST format file generated by GSDIG contains 0 (zero) data columns.

## GSPOST VERSION 9

GSPOST Version 9.0 replaces GSPOST Version 8 released in U.S. Geological Survey Open File Report 92-217 and Version 8.5 released as GSPV8.5 in Open-File report 92-372. GSPOST Version 9 has been designed to minimize pen swapping, which greatly speeds plots from very large data sets. Version 9 is like GSPV85 in that a header record in the data file provides information on the number of rows and columns and format of the file. There is essentially no limit to the number of rows that can be processed (tested with 500,000). GSPV85 and GSPOST Version 9 use the same plot control files. The GSPOST program takes data from a GSPOST format ASCII file, see p. 157-160, and plots on the screen, on a plotter, or writes to a disk file in HPGL to make maps displaying information associated with geographic sites by drawing symbols and/or posting numerical data. GSPOST operates with data sets that use latitude and longitude (geodetic) coordinates or X,Y (Cartesian) coordinates. Sites are characterized by a location in latitude, longitude or X,Y coordinates and a site identifier, and usually by numeric values for attributes of the site, such as chemical data from a sample site, or flow rates from a well. Up to 25 class intervals can be specified.

### Options:

GSPOST allows the user to specify the column from which data will be selected, values or ranges in values (class intervals), and choose different symbols (and/or different symbol sizes for each class, with or without posting of numerical values, or the posting of site identifiers. The position of posting of numerical data at each site can be adjusted to reduce over-printing of numbers by changing the position and/or the angle of the posting. These adjustments are made by on-screen editing. For any given map the X and Y scales are independent; the area is specified using the coordinates of corner points in the coordinate system chosen for locating data points (latitude,longitude or X,Y).

Plots can be made to the screen for interactive editing, to hard copy using a plotter, to an indexed position on hard copy (plot register option), or written to a disk file (HPGL).

Data points within "excluded" areas inside the plot area can be omitted if desired, and the outline of excluded areas can be drawn.

Annotations in the plot control file for each of the plotted columns can be plotted as draft "titles" if desired, so that each of a series of plots can be labeled.

### Required files for GSPOST

The user must prepare the following files before starting to operate GSPOST:

A projection parameter file is required if geodetic data is being used. This file specifies parameters for the map projection to be used. Examples on the release disk have the extension PRJ.

The data file in row-column format.

The plot control file that contains specifications of the plot. Examples on the release disk have the extension PLT.

The exclusion file specifying coordinates of areas (defined by closed polygons) inside the area of the plot inside which plotting is not to be done, if such exclusion is wanted. The example on the release disk has the extension .EXC.

The program file GSPOST.EXE and the configuration files CONFIG9.SCR and CONFIG9.PLT configured to match the system, CONFIG9.SYM, and the font files specified in the plot control file must be on the active drive of the microcomputer unless the setting of the environmental variable requires a different location.

## OPERATION OF GSPOST

Check to see that the files required for your project are available before starting GSPOST. The program is started by entering GSPOST from the DOS prompt. The screen will briefly display its disclaimer screen, then enter an interactive mode in which screen prompts will request a response, then proceed to other prompts after appropriate entries.

The first prompt will request the entry of the name of the plot control file.  
ENTER PLOT CONTROL FILENAME(QUIT TO EXIT):

Enter the full name (including extension) of the plot control file. If you are working in geodetic coordinates, after entry of the name of the file a list of files with the extension .PRJ in the default drive will be displayed, and a prompt at the bottom of the screen will call for entry of the name of the desired projection file. If the data file specifies locations in latitude, longitude coordinates the next prompt will be:  
ENTER FILENAME OF PROJECTION PARAMETERS(PLOTFILENAME.PRJ):

The default will have the name of the plot control file, with extension PRJ. This prompt will be not be displayed if Cartesian coordinates are specified. If you are using Geodetic coordinates; enter the complete name of the file, including extension, or accept the default value.

If you do not put the corners of the area to be plotted in the plot file, prompts will call for entry of plot corners. Options are provided by the prompt:

### TYPES OF MAPS

- 1- 24,000 7/12 MINUTE
- 2- 62,500 15 MINUTE
- 3- 100,000 30 MIN LAT x 1 DEG LONG
- 4- 250,000 1 DEG LAT X 2 DEG LONG
- 5- OTHER

Choice of the options 1-4 will bring a prompt for entry of the latitude, longitude coordinates of the NORTHWEST corner of the area. Entry of a 5 will bring prompts for entry of the coordinates of all four corners of the plot area. Enter the coordinate(s) requested. If map types 1-4 are chosen the UTM projection will be chosen without the necessity of entering the name of a projection parameter file.

If Cartesian coordinates are being used four prompts will call for entry of the coordinates of the corners of the plot area:

ENTER UPPER LEFT CORNER(X,Y)  
ENTER LOWER LEFT CORNER(X,Y)  
ENTER LOWER RIGHT CORNER(X,Y)  
ENTER UPPER RIGHT CORNER(X,Y)

Next, a message will be displayed providing information: the scale of the plot, the X and Y offsets, rotation, speed and force, font, width and height of characters, and the size of the map to be plotted and asking if you wish to continue:

DO YOU WANT TO CONTINUE?(Y/n):

If the size and other parameters of the plot are appropriate, respond Y, if not enter N. The default answer is Y. A prompt will next ask for input about exclusion of areas:

DO YOU WANT TO USE AN AREAL EXCLUSION FILE? (y/N):

If exclusion is needed enter Y, if not enter N. The default is N.



If you enter Y a prompt will call for entry of the name of the exclusion file:  
ENTER AREAL EXCLUSION FILENAME:

Enter the full name of the file, with extension. After this entry the screen will display status information about the current files, as in the example below:

|                             |
|-----------------------------|
| CURRENT CONTROL FILE=LL.PLT |
| AREA EXCLUSION FILE =       |
| CURRENT DATA FILE = LL.PRN  |
| NUMBER OF ROWS = 19         |
| NUMBER OF COLUMNS = 11      |
| CURRENT VARIABLE = 0        |
| NUMBER OF CLASSES = 1       |

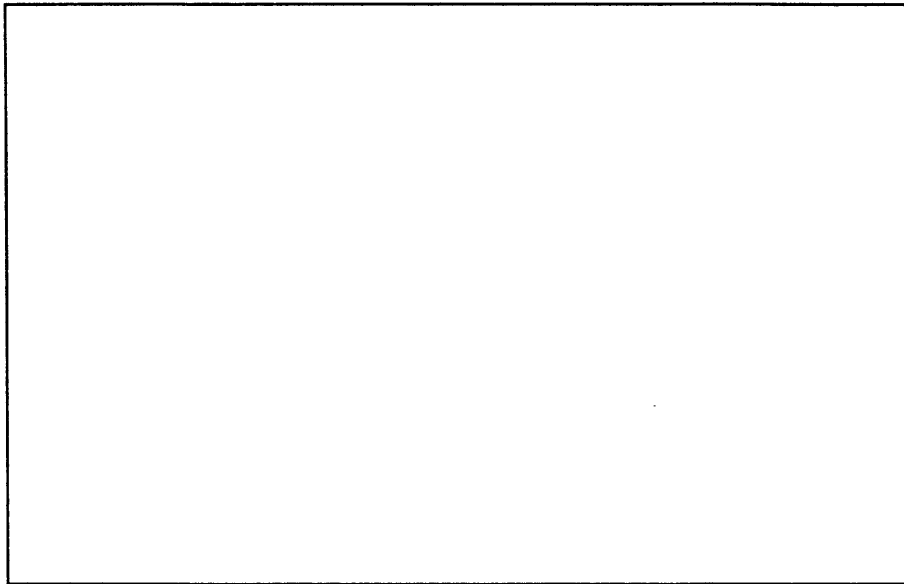
The next prompt will call for selection of the "plot option", i.e. to select between plotting to the screen, plotting on hard copy using the plotter, or sending output to an HPGL file on a disk. The prompt will be:

ENTER PLOT OPTION  
DEVICE-  
    S=SCREEN  
    P=PLOTTER  
    D=DISK  
    PR=PLOT REGISTERED  
OTHER-  
    N=NEXT VARIABLE FROM PLOTFILE  
    Q=RETURN TO DOS  
ENTER CHOICE (S,p,pr,n,q) :

Enter S, P, D, or PR to continue, or N to pass to next variable in plot file, or Q to exit to DOS. The default response is S.

The screen plot not only allows preview of the plot on the screen, but provides an interactive screen editor so that posting positions can be modified (changed in location or rotated) to reduce over-printing, plots previewed, anomalous samples identified, and the whole studied.

## Edit screen functions



-FUNCTIONS-  
A=SELECT  
B=WINDOW  
C=ZOOMOUT  
D=ORIG. WIN.  
E=REFRESH  
F=EDT. DST  
G=DRW GRID  
H=SAVE CHG  
X=EXIT

ENTER DESIRED FUNCTION

USE HOT KEYS TO SELECT

### Keyboard-mode

A=SELECT

Hitting the A key will bring a + cursor to the lower left corner of the screen, and the prompt:

↑ ↓ → ← F=FASTMODE, S=SLOWMODE, SPACE=LAST POINT, ESC=EXIT, RETURN TO FIX POINT

Use the arrow keys on the numeric keypad to move the cursor + to the symbol of the entry to be modified, using F fast mode for coarse adjustments, the S mode for fine adjustments. The editor opens in a mode moving the cursor in 10 pixel increments; in fast mode F, the cursor moves in 20 pixel increments, in slow mode S the cursor moves in one pixel steps. When the cursor is on the correct place, hit the ENTER key to identify the desired entry. The cursor will stay at this position; the function message and the prompt line will change, and information will be displayed about the point chosen (row in the table, identifier, posting angle, and Z value).

### Mouse-mode

A=SELECT

Hitting the A key will bring the mouse cursor to the screen, and the prompt:

PLACE CURSOR ON SYMBOL CLICK LEFT BUTTON TO SELECT RIGHT TO EXIT

Move the cursor to the symbol of the entry to be modified by moving the mouse. Identify the entry by clicking the left mouse key (clicking the right mouse key returns operation to the ENTER DESIRED FUNCTION prompt).

The entry you have selected will be highlighted on the screen (bright white) and information will be displayed about the point chosen on the right side of the screen, (row in the table, identifier, and posting angle).

The prompt line will change to:

A=Modify, SPACE BAR TO CONTINUE SEARCH X TO EXIT

If you enter A The prompt line will change to:

A=CHANGE ANGLE, B=CHANGE LOCATION, X=EXIT, see description on next page.

Hit the **A** key to change the angle of posting. The prompt line will change to:  
**ENTER NEW POSTING ANGLE: ?**

Enter the angle desired; 0 degrees posts to the right of the symbol, 180 degrees to the left, angles between 0° and 180° change the angle of posting in a counterclockwise direction. Negative angles change posting in a clockwise direction. The screen will show the new posting, and if satisfactory, **X** to exit will return operation to the previous screen, or if you wish to change the location of the posting, hit **B** and continue.

**B=CHG.LOC**

Hitting the **B** key (keyboard mode) brings the prompt:  
**↑ ↓ → ← F=FASTMODE,S=SLOWMODE,SPACE=LAST POINT,ESC=EXIT,RETURN TO FIX POINT**

Use the arrow keys to move the + cursor to the new posting position desired, then hit the **ENTER** key to establish the new position. The screen will show the new posting, and if satisfactory, **C** to exit will return operation to the previous screen. If the position is not satisfactory, use **B** to try again. Remember that if the angle of posting is 0 the posting position is relative to a point at the lower left corner of the block occupied by the posting, but displaced to the right a distance corresponding to the size of the symbol. But if the posting angle is 180°, posting will be to the left of the point, and relative to the lower right corner of the posting, and displaced to the right a distance corresponding to the size of the symbol. The cursor position will be marked on the screen until it is refreshed to assist accurate location.

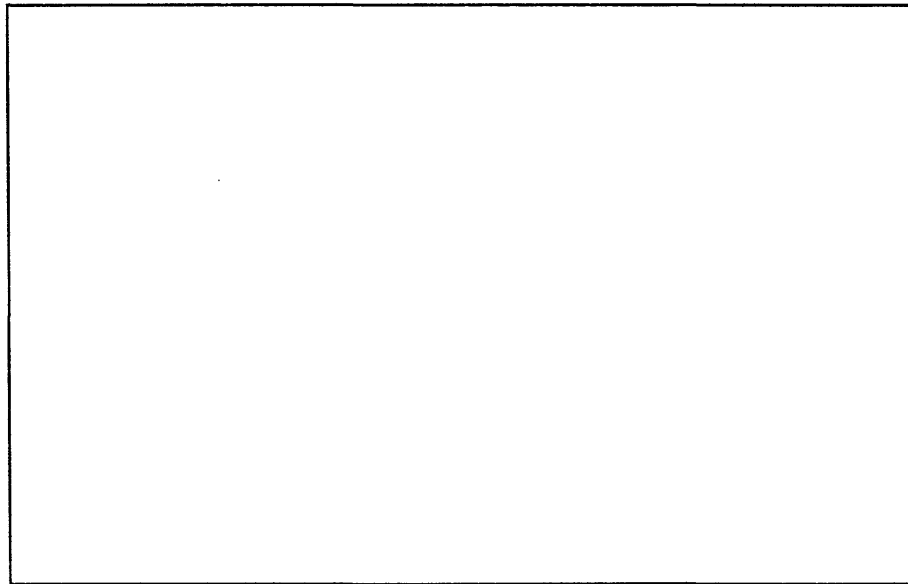
Hitting the **B** key (mouse-mode) brings the prompt:  
**PLACE CURSOR ON NEW LOCATION-LEFT BUTTON TO SELECT-RIGHT TO EXIT**

Move the cursor to the position desired for posting, click the left key. When satisfactory, hit **C** to return to the first screen.

**X=EXIT**

Hit **X** to return to the previous screen to continue operations, i.e. choose another function, or continue the identification process.

## Additional edit screen functions



**-FUNCTIONS-**  
**A=SELECT**  
**B=WINDOW**  
**C=ZOOMOUT**  
**D=ORIG.WIN.**  
**E=REFRESH**  
**F=EDT.DST**  
**G=DRW GRID**  
**H=SAVE CHG**  
**X=EXIT**

ENTER DESIRED FUNCTION

USE HOT KEYS TO SELECT

### Keyboard-mode

**B=WINDOW**

Entering **B** (keyboard mode) will bring a cursor + to the lower left corner of the screen window (box) and a prompt to the bottom of the screen:

↑ ↓ → ← **F**=FASTMODE,**S**=SLOWMODE,**SPACE**=LAST POINT,**ESC**=EXIT,**RETURN** TO FIX POINT

Use the arrow keys to move the cursor + to the lower left corner of the area to be windowed, using the **F** fast mode for coarse adjustments, the **S** mode for fine adjustments. Hitting the **ENTER** key establishes the lower left corner of the new window. A second cursor + will appear at the upper right corner of the screen, and the prompt will change. Use the arrow keys to move the second cursor + to the upper right corner of the area to be windowed, then hit the **ENTER** key to establish the window. The windowed area will be redrawn on the screen at the newly specified scale. Further windowing can be done, or editing can proceed. The cursors can be moved outside the screen plot window, and although they will not be drawn, the windowing process can be used to enlarge the window slightly. If a much larger window is needed, it is better to use the **D** function to step back to the entire area as shown initially on the screen plot or the **C** function to step out in increments (enlarged on all sides by 25% of the size of the screen window). Only points inside the window will be posted; labels from points inside the window may extend outside the window. Adjust the size of the window carefully.

### Mouse-mode

**B=WINDOW**

Hitting the **B** key will bring the mouse cursor to the screen and the prompt:

**PLACE CURSOR AT LOWER LEFT CORNER-LEFT BUTTON TO MARK IT-RIGHT TO EXIT**

Move the cursor with the mouse to the desired position for the lower left corner of the window, click the left key, then move to the upper right corner of the window and again click the left key. The screen will be re-plotted to show this view.

#### **C=ZOOM OUT**

To increase the size of the window in finite steps (up to the size of the original window, hit the C key. The window will be increased by 25% on all sides. This process can be repeated until the original window has been attained.

#### **D=ORIG.WND.**

To step back to the screen display at the start of the edit sequence (original window), use the D function; for example, if you need to select a new area for continued editing.

#### **E=REFRESH**

Redraw the screen from the file by hitting the E key to refresh the screen. This gets rid of extra cursor points left from a sequence of editing several points.

#### **F=EDT.DST.**

Change the edit distance by hitting the F key. The default value at the start of a session is 0.1 (inches). ENTER POINTING DISTANCE(0.1): ?

the prompt calls for entry of a new value, e.g. enter 0.5 to identify points further from the cursor location.

#### **G=DRW GRID**

To draw reference grid points on the screen, select function G. A prompt will ask for entry of the delta spacing you wish, e.g. in geodetic coordinates the prompt will be:  
ENTER DELTA(DD,MM,SS):

In Cartesian coordinates the prompt will be:  
ENTER DELTA:

The Cartesian grid spacing entered is in inches at plot scale. Enter the spacing desired. A grid defined by + symbols will be plotted on the screen. This grid is not preserved if the screen is windowed, but can be redrawn after windowing.

#### **H=SAVE CHG**

Changes made during editing can be saved to a new data file by entering G. A prompt will be displayed asking for the name of the new file. Enter the full name of the new file, including the extension; GSPOST will not allow you to overwrite an existing file. Grid points from the edit sequence are not stored in the data file.

#### **X=EXIT**

If plotting from several columns is specified in the plot control file, entry of X takes the system back to the plot option prompt:

DEVICE-

S=SCREEN

P=PLOTTER

D=DISK

PR=PLOT REGISTERED

OTHER-

N=NEXT VARIABLE FROM PLOTFILE

Q=RETURN TO DOS

ENTER CHOICE (S,P,PR,,N,Q) :

Enter S, P, PR or D to continue, Or N to continue with another variable from the plot file, or Q to exit to DOS.

If plotting of all columns has been completed, and all edit changes have been saved, the system will return to the DOS prompt. If all changes haven't been saved, a reminder will prompt:  
DO YOU WANT TO SAVE CHANGES ?(y/N) (the default is N):

If you want to save the changes made to the control columns in a data file, enter Y and a prompt will ask for the name of the file. Enter the full name of the file with extension. A final prompt will be:

DO YOU WANT TO PROCESS ANOTHER FILE (Y/N):

If you want to continue the GSPOST session enter Y and proceed (from the prompt asking if you wish to use geodetic or Cartesian coordinates). Entry of N will return the system to the DOS prompt.

#### Hard-copy plots

If you enter P to go to the plotter, a reminder will be shown:  
PLOTTER SHOULD BE ON AND PAPER LOADED!!!!!!  
HIT ANY KEY WHEN READY

DO YOU WANT TO DRAW CORNER BRACES? (Y/N) Answer Y or N as desired.  
DO YOU WANT INTERNAL TICK MARKS? (Y/N) Answer Y or N as desired.

Hit a key to start plotting. GSPOST will drive the plotter according to specifications in the plot control file.

You will also have the opportunity to draw or not draw the outlines of the excluded areas. Corner and interior ticks and outlines will be drawn using pen #1. After these entries, the computer will show a prompt much like one at a previous stage:

#### Registered Plots

The PR PLOT REGISTERED option when plotting on the plotter allows the plot to be placed at a chosen position on a sheet in the plotter. When using this option, put a sheet in the plotter with the corners to be matched clearly marked on it, and select the PR option. Prompts will be displayed on the screen, respond to each in turn.

DO YOU WANT TO DRAW CORNER BRACES? (Y/N) Answer Y or N as desired.

DO YOU WANT INTERNAL TICK MARKS? (Y/N) Answer Y or N as desired. Follow the prompts as listed below.

INSERT DIGITIZING SIGHT IN PEN POSITION 1

HIT ENTER KEY ON KEYBOARD WHEN READY

HIT PEN UP KEY ON PLOTTER TO LOAD DIGITIZING SIGHT

MOVE SIGHT TO APPROXIMATE POSITION OF NW CORNER USING PLOTTER CONTROLS.

HIT PEN DOWN, MOVE TO EXACT POSITION AND DIGITIZE NW CORNER BY HITTING ENTER KEY ON PLOTTER

HIT ENTER KEY ON KEYBOARD TO CONTINUE

Prompts will be added to the screen so that the SW and SE corners can be indexed (digitized). Follow directions.

DIGITIZE SW CORNER

HIT ENTER KEY TO CONTINUE

DIGITIZE SE CORNER

HIT ENTER KEY TO CONTINUE

REMOVE DIGITIZING SIGHT AND REPLACE WITH PEN

HIT ANY KEY TO CONTINUE

After the plot has been drawn, operations will return to the ENTER PLOT OPTION prompt.

ENTER PLOT OPTION

DEVICE-

S=SCREEN

P=PLOTTER

D=DISK

OTHER-

N=NEXT VARIABLE FROM PLOT FILE

Q=RETURN TO DOS

ENTER CHOICE (S,p,pr,d,n,q):

Enter S, P, PR, D, or Q to exit to DOS, or N to continue plotting if data from another column (another variable) is to be plotted. If only a single variable is used in the plot control file, both Q and N will return the system to the DOS prompt. If several variables are to be plotted, entry of N will begin the plot of data from the column specified next in the plot file. The sequence can be continued until the required plots for all data columns have been completed.

#### Plotting to a file

If D is answered, a prompt will request:

ENTER DISK FILENAME:

Enter the name you choose for the output file. The next prompt will ask for entry of the values for the scaling points, P1X, P1Y, P2X, P2Y. See p. 333 and plotter documentation for values. After entry of the scaling points, e. g., 80,320,10080,7520 the font and data will be loaded and a prompt will request an entry so that operations can continue.

ENTER PLOT OPTION

DEVICE-

S=SCREEN

P=PLOTTER

D=DISK

OTHER-

N=NEXT VARIABLE FROM PLOT FILE

Q=RETURN TO DOS

ENTER CHOICE (S,p,pr,,n,q):

Entry of N will load the next set of instructions from the plot control file and return to the menu. This process can continue until the plot is complete. HPGL output files can be used to generate plots on a plotter, using a program such as QUEIT, this volume. Duplicate plots generally will take less time if made from HPGL files using Queit than when made using GSPOST.

Proprietary programs are available that use laser printers or 24 pin dot matrix printers to make plots from HPGL files e.g. "Print-A-Plot". Some laser printers accept HPGL graphic files as direct input.

## GSPOST PLOT CONTROL FILES

The user must create a GSPOST plot control file before using GSPOST. A plot control file contains a series of ASCII records (lines) that specify parameters that control the area, size, orientation and content of the maps that are to be generated. The list below is for a file where map corners are specified in the plot control file.

Record 1: The full name of the data file with extension.

Record 2: Y or N; N if coordinates are specified in the plot control file, Y if corner coordinates are to be entered interactively from the keyboard.

Record 3: Latitude, Longitude of NW corner of plot area, format DD,MM,SS,C,DDD,MM,SS,C OR X,Y coordinates of the upper left corner of the area.

Record 4: Latitude, Longitude of SW corner of plot area, format DD,MM,SS,C,DDD,MM,SS,C, OR X,Y coordinates of the lower left corner of the area.

Record 5: Latitude Longitude of SE corner of plot area, format DD,MM,SS,C,DDD,MM,SS,C, OR X,Y coordinates of the lower right corner of the area.

Record 6: Latitude Longitude of NE corner of plot area, format DD,MM,SS,C,DDD,MM,SS,C, OR X,Y coordinates of the upper right corner of the area.

Record 7: X scale, Y scale. For Geodetic coordinates, the denominators of the scale fractions, e.g. 24000,24000 (for 1:24,000 scale maps); for Cartesian coordinates the numerator of the scale multiplier, e.g. 2,2 for maps twice the size plotted at 1,1.

Record 8: The offset in inches from the plotter default origin near the corner of the plotter paper for the SW (lower left) corner of the plotted map; see plotter documentation, e.g. 1,3, for XOFF=1", YOFF=3".

Record 9: This record specifies rotation on the plot media, see plotter documentation, and p. 333, Y= yes rotate, or N= no, don't rotate, e.g. N.

Record 10: Speed and Force, these values specify the speed of drawing lines in cm/sec and the pressure on the pen, e.g. 25,1, refer to plotter manuals for recommended values, and see Appendix 1.

Record 11: The font number, width and height in inches for posted numbers and letters, e.g. 0,0.04,0.06. This does not refer to symbol size.

Record 12: Y (plot the title) or (N) don't plot the title, X offset from the SW (LL) plot corner, Y offset from the SW (LL) corner, angle of rotation for title, e.g. Y,1,-0.25,0.

Succeeding records contain information specifying the data column(s) which are to be used, the kinds and sizes of symbols that are to be drawn, and the posting that is desired. These records group into two types.



Type 1: A record with two numerical entries specifies the data column selected, and the number of classes (ranges) to be used to plot that data. The data column is specified by number, followed by the number of classes, e. g. 3,4, specifies four classes to be separately plotted from the data in the third data column. The second number must be followed by a comma and after this annotations within double quote marks are permitted. These annotations are used for the "title" when the title option is selected. The purpose of this title is to keep a series of plots identifiable, not the creation of a finished publishable map. A complete explanation with symbols, ranges, text, and such, is beyond the scope of GSPOST. This can be done using GSMAP, and the GSPOST plot and GSMAP explanation then plotted on the same sheet at a later time.

Type 2: Each class of data requires a record in the file - the entry of 4 above requires four succeeding records. Each record specifying classes contains six entries separated by commas; in sequence, (1) the low value for the class (values selected will be greater than or equal to the low value), (2) the high value for the class (values selected will be less than the high value), (3) the pen to be used (pen position in the carousel in the plotter by number), (4) the number of the symbol to be used, (5) the size of the symbol in thousandths of an inch, and (6) Y or N which specifies whether posting of the numerical value from the table at this point is desired (Y) or not (N). For example 20,50,3,11,100,N specifies that values ranging from 20 to 50 are to be selected, symbol 11 is to be used, and drawn 100/1000 inch high.

A record of Type 1 must be followed by the requisite number of records (lines) of type 2 specifying class intervals, pen, symbol, size, and posting "Y" or "N". Subsequent records of Type 1 followed by specified numbers of records of Type 2 can be used to plot data from other columns.

To plot a symbol at each locality and post the locality identifiers, insert a record reading 0,1 at any position appropriate for a type 1 record. Follow this record with a type 2 record specifying 0, 0, Pen #, Symbol #, Symbol size. Generally it works best to insert these records after record #12 or #11 that specifies the number of rows and columns in the data file. This facilitates editing of posting positions.

No special record is required to mark the end of the plot file. The carriage return at the end of the last line of the plot file marks the end of the plot file.

## Examples of GSPOST plot control files

The plot files contain only the information in the left column of the print-out below.

### Geodetic coordinate plot control file to plot data

| Entries in Plot File      | Notes on contents of plot file                                   |
|---------------------------|------------------------------------------------------------------|
| TESTDD1.PRN               | FILENAME.EXT of data file                                        |
| N                         | "N" No, plot corners will not be specified interactively         |
| 44,0,0,N,113,57,0,W       | Lat/Lon NW Corner                                                |
| 43,52,0,N,113,57,0,W      | Lat/Lon SW Corner                                                |
| 43,52,0,N,113,45,0,W      | Lat/Lon SE Corner                                                |
| 44,0,0,N,113,45,0,W       | Lat/Lon NE Corner                                                |
| 250000,250000             | XSCALE, YSCALE                                                   |
| 0,0                       | XOFF=0, YOFF=0                                                   |
| N                         | "N", Don't rotate plot                                           |
| 25,1                      | Speed,Force                                                      |
| 0,0.1,0.15                | Font#=0,Width=0.1", Height=0.15" for characters to be posted     |
| Y,1,-0.2,0                | Yes plot title,at X=1,Y=-0.2,Rotation=0                          |
| 2,3, "TITLE"              | Use column 2, 3 classes, Annotation within quote symbols         |
| 0, 1000, 1, 1, 25, N      | Range 0-1000, Pen 1, Symbol 1, 25/1000 inch, "N" don't post      |
| 1000, 1100, 1, 41, 150, N | Range 1000-1100, Pen 1, Symbol 41, 150/1000 inch, "N" Don't post |
| 1100, 1500, 1, 41, 225, N | Range 1100-1500, Pen 1, Symbol 41, 225/1000 inch, "N" Don't post |
| 3,2,"ANNOTATION"          | Use column #3, 2 classes, Annotation                             |
| 65, 75, 2, 42, 150, N     | Range 65-75, Pen 2, Symbol 42, 150/1000 inch, "N" Don't post     |
| 110, 150, 2, 42, 225, N   | Range 110-150, Pen 2, Symbol 42, 225/1000 inch, "N" Don't post   |
| 4,1,"ANNOTATION"          | Use column #4, 1 class                                           |
| 25, 40, 1, 43, 150, N     | Range 25-40, Pen 1, Symbol 43, 150/1000 inch, "N" Don't post     |

# Geodetic plot control file to plot locality identifiers

| Entries in Plot File   | Notes on contents of plot file                                |
|------------------------|---------------------------------------------------------------|
| TESTDD1.PRN            | FILENAME.EXT of data file                                     |
| N                      | "N" No, plot corners will not be specified interactively      |
| 44,0,0,N,113,57,0,W    | Lat/Lon NW Corner                                             |
| 43,52,0,N,113,57,0,W   | Lat/Lon SW Corner                                             |
| 43,52,0,N,113,45,0,W   | Lat/Lon SE Corner                                             |
| 44,0,0,N,113,45,0,W    | Lat/Lon NE Corner                                             |
| 250000,250000          | XSCALE, YSCALE                                                |
| 0,0                    | XOFF, YOFF                                                    |
| N                      | "N", Don't rotate plot                                        |
| 25,1                   | Speed,Force                                                   |
| 0,0.1,0.15             | Font=#0, Width=0.1", Height=0.15" for characters to be posted |
| Y,1,-0.25,0            | Yes plot title at X=1,Y=-0.25,Rotation=0                      |
| 0,1,"LOCALITY NUMBERS" | Use column #0=Locality identifiers, 1 class, end with a comma |
| 0,0,4,5,50,Y           | Range 0-0, Pen 4, Symbol 5, 50/1000", "Y" Post identifiers    |

Plot files for GSPOST when corners of the plot are specified interactively are like those above except that the plot corners are not specified in the file and the second line of the file is a Y, see example below.

## Geodetic plot control file to plot locality identifiers, interactive plot corners

| Entries in Plot File   | Notes on contents of plot file                                |
|------------------------|---------------------------------------------------------------|
| TESTDD1.PRN            | FILENAME.EXT of data file                                     |
| Y                      | "Y" Yes, plot corners will be specified interactively         |
| 250000,250000          | XSCALE, YSCALE                                                |
| 0,0                    | XOFF, YOFF                                                    |
| N                      | "N", Don't rotate plot                                        |
| 25,1                   | Speed,Force                                                   |
| 0,0.1,0.15             | Font=#0, Width=0.1", Height=0.15" for characters to be posted |
| Y,1,-0.25,0            | Yes plot title at X=1,Y=-0.25,Rotation=0                      |
| 0,1,"LOCALITY NUMBERS" | Use column #0=Locality identifiers, 1 class, end with a comma |
| 0,0,4,5,50,Y           | Range 0-0, Pen 4, Symbol 5, 50/1000", "Y" Post identifiers    |

Cartesian coordinate plot control file to first plot site identifiers, then plot data

| Entries in Plot File | Notes on contents of plot file                                      |
|----------------------|---------------------------------------------------------------------|
| XY.PRN               | FILENAME.EXT of data file=XY.PRN                                    |
| N                    | "N" No, plot corners will not be specified interactively            |
| 115.75,39            | X,Y coordinates NW Corner                                           |
| 115.75,38.75         | X,Y coordinates SW Corner                                           |
| 116,38.75            | X,Y coordinates SE Corner                                           |
| 116,39               | X,Y coordinates NE Corner                                           |
| 20,20                | XSCALE=20, YSCALE=20                                                |
| 1,2                  | XOFF=1", YOFF=2"                                                    |
| Y                    | "Y" Rotate plot                                                     |
| 25,1                 | Speed=25,Force=1                                                    |
| 0,0.07,0.1           | Font=#0, Width=.07, Height=.1 of characters to be posted            |
| Y,-0.5,0.5,90        | Yes plot titles, at X=-0.5,Y=0.5,Rotate 90 degrees counterclockwise |
| 0,1, "IDENTIFIERS"   | Use column #0, 1 class,Annotation=IDENTIFIERS                       |
| 0,0,3,5,50,Y         | Range 0-0, Pen 3,Symbol 5, 50/1000", "Y" post identifiers           |
| 3,2, "COLUMN 3=Ag"   | Use column 3, 2 classes,"Annotation"                                |
| 0,18,1,30,50,N       | Range 0-18, Pen 1, Symbol 30,50/1000 inch, "N" don't post           |
| 18,100,1,30,50,N     | Range 18-100, Pen 1, Symbol 30,50/1000 inch, "N" Don't post         |
| 5,3, "COLUMN 5=Mn"   | Use column 5, 3 classes,"Annotation"                                |
| 0,1,1,30,50          | Range 0-1, Pen 1,Symbol 30,50/1000 inch, "N" Don't post             |
| 1,2,3,32,100,N       | Range 1-2, Pen 3, Symbol 32, 100/1000 inch, "N" Don't post          |
| 2,2000,1,32,150,N    | Range 2-2000, Pen1, Symbol 32, 150/1000 inch, "N" Don't post        |
| 6,2, "COLUMN 6=As"   | Use column #6, 2 classes, "Annotation"                              |
| 0,1,1,30,50,N        | Range 0-1 Pen 1, Symbol 30, 50/1000 inch, "N" Don't post            |
| 0.1,0.2,1,33,250,N   | Range 0.1-0.2, Pen 1, Symbol 33,250/1000 inch, "N" Don't post       |
| 7,3, "COLUMN 7=Ti"   | Use column #7, 3 classes, "Annotation"                              |
| 0,10,1,9,50,N        | Range 0-10, Pen 1, Symbol 9, 50/1000 inch, "N" Don't post           |
| 10,25,1,34,100,N     | Range 10-25, Pen 1, Symbol 34, 100/1000 inch, "N" don't post        |
| 25,1000,3,34,150,Y   | Range 25-1000, Pen 3, Symbol 34, 150/1000 inch, "Y" post            |

### GSPOST EXCLUSION FILES

Exclusion files are used to specify coordinates of areas that are to be excluded from plotting. One to ten areas may be excluded. The coordinates of the four corners of an area or areas are supplied in degree, minute second format, in the sequence NW, SW, SE, and NE for geodetic coordinates as shown in the example below that specifies two areas for exclusion. No head or trailing records are permitted and the file must end with a carriage return.

|                       |        |
|-----------------------|--------|
| 48,37,30,N,93,30,00,W | Area 1 |
| 48,30,00,N,93,30,00,W |        |
| 48,30,00,N,93,15,00,W |        |
| 48,37,30,N,93,15,00,W |        |
| 48,15,00,N,92,22,30,W | Area 2 |
| 48,07,30,N,92,22,30,W |        |
| 48,07,30,N,92,15,00,W |        |
| 48,15,00,N,92,15,00,W |        |

If using Cartesian coordinates, exclusion files must contain the X and Y coordinates of the four corners of the area to be excluded using the units of the data in the sequence, X,Y for the upper left corner, X,Y for the lower left corner, X,Y for the lower right corner, and X,Y for the upper right corner.

## GSPUTIL

The GSPUTIL program selects data from input files in the GSPOST row/column format and generates output files in the same format; it includes coordinate conversion and sorting of the sequence of rows in the data file, functions of the GSPCT and GSPCVT programs released in System 8, and adds trim capabilities enabling selection or exclusion of data from geographically selected parts of the input file. The GSPUTIL menu screen offers 5 choices. Start the program by entering **GSPUTIL**

```

      G S P U T I L
      System 9.00

1 = COORDINATE CONVERSION
2 = SORT
3 = TRIM AGAINST POLYGON BOUNDARY
4 = TRIM AGAINST AREAL EXCLUSION FILE
5 = EXIT
```

### OPTION 1, COORDINATE CONVERSION

Option 1, like its predecessor, the GSPCT program, enables conversion of the location coordinates of GSPOST format file from one coordinate type to another. Select option 1 from the menu by typing 1. The first prompt lists the conversions supported. If conversions between geodetic and Cartesian coordinates are to be specified, projection parameter files must be prepared before starting the program. The GSPOST input data file can have an unlimited number of rows.

The first message prompts for the conversion to be selected:  
FOLLOWING CONVERSIONS ARE AVAILABLE:

- 1 - CONVERT LATITUDE LONGITUDE (DD,MM,SS,C,DDD,MM,SS,C)  
TO DECIMAL DEGREES (DD)
- 2 - CONVERT LATITUDE LONGITUDE (DECIMAL DEGREES) TO  
DEGREES, MINUTES, SECONDS (DD,MM,SS,C,DDD,MM,SS,C)
- 3 - CONVERT LATITUDE LONGITUDE (DD,MM,SS,C,DDD,MM,SS,C)  
TO X,Y METERS
- 4 - CONVERT LATITUDE LONGITUDE (DECIMAL DEGREES)  
TO X,Y METERS
- 5 - CONVERT X,Y METERS TO LATITUDE-LONGITUDE  
DECIMAL DEGREES (DD)
- 6 - CONVERT X,Y METERS TO LATITUDE-LONGITUDE  
DEGREES, MINUTES, SECONDS (DD,MM,SS,C,DDD,MM,SS,C)

Choice of 1 or 2 from this list converts geodetic coordinates from DD to DMS or the inverse. These

choices facilitate merging of data files. Although GSPOST and related programs will support either DD or DMS formats, each data file must be in a single format.

Choice of 3 or 4 converts geodetic coordinates to Cartesian coordinates. Use of Cartesian coordinates speeds the process of editing to reduce over-posting of data, especially on slower computers. If the proper UTM projection file is selected, the program will write out the UTM coordinates, including the addition of the 500000 FALSE EASTING.

Choice of 5 or 6 Converts coordinates in data files from UTM meters (UTM Cartesian coordinate system) to geodetic coordinates. Some data files were prepared using UTM coordinates before digitizers made the process of determining geodetic coordinates relatively painless.

After selection of the conversion desired, prompts request responses familiar to users of GSPOST:

ENTER INPUT GSPOST FILENAME e.g. DATA.OLD

If a geodetic to Cartesian conversion or the inverse is required, a prompt will call for the name of the projection parameter file; this prompt will be skipped for conversion types 1 and 2.

ENTER FILENAME OF PROJECTION PARAMETERS: ? e.g. UTM105.PRJ

ENTER FILENAME FOR OUTPUT: e.g. DATA.NEW

The program will operate, then return to the GSPUTIL menu when the output file is complete.

If conversion choice 4 is used to convert latitude, longitude values to UTM meters the appropriate 500000 false easting will be added (addition of 50000 to prevent negative values). In the southern hemisphere the 10,000,000 false northing value is added (addition of 10,000,000 to prevent negative values and ensure increasing values to the North).

## Option 2, SORT

Option 2 from the menu, like its predecessor, the GSPSRT program, enables sorting of a GSPOST file to an output file to reduce plotting time. Plotting time for production of large GSPOST plots may be significantly reduced by organizing randomly located data points into blocks of closely spaced points so that the plotter head doesn't have to move farther than necessary between points. The program reads the data to determine the minimum and maximum in X and the minimum and maximum in Y. It then divides the area into the number of blocks in X and in Y (Latitude and Longitude) specified by the user, and writes a file with data points organized by block. The GSPOST data file can have up to 15,000 rows (data points).

The first prompts are familiar to GSPOST users:

ENTER GSPOST FILENAME e.g. DATA.OLD

Responses to the next two prompts define the number of blocks. Coordinates are sorted in ascending sequence.

NUMBER OF BLOCKS IN LATITUDE:

Enter the number of blocks, e.g 2

NUMBER OF BLOCKS IN LONGITUDE:

Enter the number of blocks e.g. 10

ENTER FILENAME FOR OUTPUT: e.g. DATA.SRT

After entry of the name of the output file, the program will operate, then return to the DOS prompt. An entry of 0 (zero) as the number of blocks creates the default value of 10. An entry of 1 will divide the area into two blocks (one dividing partition).

This option program will sort files with as many as 15,000 records; up to 100 blocks in X and up to 100 in Y can be selected. A first test on a file with nearly 2,000 records indicated that block sorting produced a file that took a third less time to plot than the original data file. Sorting is from the NW (upper left) corner of the data to the SE (lower right corner). This sequence is preserved by Option 15 of the GSMUTIL program that creates a GSMAP data base from a GSPOST file. This sequence corresponds to the upper left to lower right numbering system generally favored by map editors.

## Option 3, TRIM AGAINST POLYGON BOUNDARY

Option 3 is used to select points from an input GSPOST data file that are inside one closed polygon defined in an "EXCLUSION" file using up to 5,000 points, and create an output GSPOST data file containing only the selected points. The prompts are familiar to GSPOST users; answer each in turn.

ENTER GSPOST FILENAME e.g. DATA.OLD

ENTER FILENAME OF AREAL EXCLUSION FILE:

DECIMAL DEGREES OR DEGREES, MINUTES, SECONDS, C(dd/DMS):

ENTER FILENAME FOR OUTPUT:

#### Option 4, TRIM AGAINST AREAL EXCLUSION FILE

Option 4 is used to select points from an input GSPOST data file that are either inside or outside of up to 10 areas, each defined by four entries (maximum latitude, minimum latitude, maximum longitude, minimum longitude, or X MAX, X MIN, Y MAX, Y MIN) in an ASCII file, and create a new GSPOST data file containing only the points inside or outside areas, as chosen.

ENTER FILENAME OF AREAL EXCLUSION FILE:

DECIMAL DEGREES OR DEGREES,MINUTES,SECONDS,C(dd/DMS):

DO YOU WANT THE DATA INSIDE OR OUTSIDE THE EXCLUDED AREAS?(i/O):?

ENTER FILENAME FOR OUTPUT:

Options 1, 3, and 4. Because of the mechanics of production of the output file, 0's (zero's) may be added to the right of the decimal point in the data columns. Be careful to check these output values. GSPOST won't plot them, GSMAP will.



## GSPUV

The GSPUV program applies standard univariant statistical algorithms to row-column ASCII files in GSPOST format (up to 15,000 rows, up to 50 data columns) and displays the chosen statistical parameters on the screen (use a screen print function to record the results) or to an ASCII file that will provide the statistical results of the session. Its objectives are simple; we hope to provide a quick statistical look at a single column of data and to assist the user in the choice of parameters when writing plot control files for the GSPOST program. It will generate histograms with up to 50 classes) as graphical output on the screen, to the plotter, to a disk file, or to a GSMAP data base. Histograms can be drawn using the values in the data file or using the log (base 10) of the values in the file. The prompts are straightforward; answer each in turn.

ENTER GSPOST FILENAME: Enter the name of the GSPOST data file e.g. LL.PRN

FREQUENCY DISTRIBUTION?(Y/n): Enter Y or N. If Y

HISTOGRAMS?(Y/n): Enter Y or N.

SAVE STATISTICS AND FREQUENCY TABLES TO AN ASCII FILE? (y/N): If Y

ENTER FILENAME FOR ASCII OUTPUT:

Enter the name of the file to record the statistics from the session, e.g. STAT.DAT.

ENTER DATA COLUMN: Enter the number of the data column to be analyzed, e.g. 11.

LOGS BASE 10? (y/N): Enter Y or N

Enter Y if values and histograms are to be based on the log(base 10) of the value in the data table.  
After a brief period for calculation the screen will display values as below:

| Column 11                  |   |             | PERCENTILES |          |
|----------------------------|---|-------------|-------------|----------|
|                            |   |             | %           | VALUES   |
| Sum of the Values          | = | 2,202.5330  | 5           | 21.5695  |
| Mean                       | = | 115.9228    | 10          | 29.9775  |
| Standard Error of the Mean | = | 26.5945     | 25          | 49.4760  |
| Variance                   | = | 28,583.6172 | 50          | 67.1684  |
| Standard Deviation         | = | 169.0669    | 75          | 100.3285 |
| Coefficient of Variation   | = | 1.4584      | 90          | 153.5925 |
| Skewness                   | = | 3.3281      | 95          | 261      |
| Kurtosis                   | = | 12.9295     |             |          |
| Minimum Value              | = | 21.9810     |             |          |
| Maximum Value              | = | 784.8640    |             |          |
| Range                      | = | 762.8830    |             |          |
| Minimum Z Score            | = | -0.5556     |             |          |
| Maximum Z Score            | = | 3.9567      |             |          |

If you have asked for calculation of the frequency distribution, after you hit a key to continue, information like the following will be displayed:

MINIMUM 8

MAXIMUM 4000

If log (base 10) values have been selected, both values and log values will be shown, as below:

MINIMUM, LOG = 24 1.380211

MAXIMUM, LOG = 78100.01 4.892651

Prompts will call for entries:

**Enter Lower Limit of First Class:** Enter in terms of values, use log values if logs have been selected for output.

**Enter Class Interval:** As above, enter in terms of values to be plotted (logs, if logs). If the class interval is so small as to request more than 50 classes, the error message will be seen:

Error message:

MORE THAN 50 CLASSES TO INCLUDE MAXIMUM  
RESPECIFY LOWER LIMIT AND CLASS INTERVAL  
HIT ANY KEY TO CONTINUE

If frequency distribution information has been requested information as below will be printed on the screen.

| CLASS | LOWER BOUND | FREQ | % FREQ | CUM %  |
|-------|-------------|------|--------|--------|
| 1     | 0.0000      | 12   | 52.17  | 52.17  |
| 2     | 100.0000    | 0    | 0.00   | 52.17  |
| 3     | 200.0000    | 0    | 0.00   | 52.17  |
| 4     | 300.0000    | 0    | 0.00   | 52.17  |
| 5     | 400.0000    | 0    | 0.00   | 52.17  |
| 6     | 500.0000    | 0    | 0.00   | 52.17  |
| 7     | 600.0000    | 1    | 4.35   | 56.52  |
| 8     | 700.0000    | 6    | 26.09  | 82.61  |
| 9     | 800.0000    | 4    | 17.39  | 100.00 |

HIT RETURN TO CONTINUE

ENTER PEN NUMBER FOR BARS: e.g. 3

The histogram selected will be displayed on the screen, with the message:

HIT RETURN TO CONTINUE? Opportunity is provided to make other sorts of plots.  
CHANGE PLOTTING DEVICE(y/N)? If Y

PLOTTER,DISK?(p,d): ? e.g. P

If plotter:

PLOTTER SHOULD BE TURNED ON AND PAPER LOADED HIT ANY KEY WHEN READY

The plotter will plot the histogram; pen 1 is used for lines and letters and the outline of the bars; the selected pen will be used for the columns (bars). The bars will be plotted 0.2" wide. The vertical axis will be plotted 4" high (= 100%).

If D has been chosen for output:

ENTER DISK FILENAME: Enter the name for the HPGL file.

ENTER P1X,P1Y,P2X,P2Y (see p. 333 and plotter documentation for information on scaling points), e.g. 80,320,10080,7520 for 8 1/2 x 11 inch plots.

Opportunity will be afforded to create a GSMAP data base.  
WRITE OUT GSMAP DATA BASE(y/N)?

If Y (yes):

ENTER DATA BASE NAME: ? e.g. H1

ENTER TITLE(8 CHARS.): ? HISTOGRAM1

The return to the ENTER DATA COLUMN prompt completes this cycle of operation.

#### EXIT

A series of columns can be examined in turn, then to return to DOS hit the ENTER key instead of entering the number of a column at the ENTER DATA COLUMN: prompt.

#### GSMAP DATA BASES

Codes 91 and 92 are used for the frame and the percent tick marks, respectively.

Code 93 is used for tick marks below the base line that indicate the limits of the class interval.

Code 192 is used to record the labels for the percent ticks;

values recorded as P1, P2=0.

Code 400 is used for the bars.

Other labeling of the GSMAP plot is left to the user.

## GSPPROB

The GSPPROB program will create probability plots using data from GSPOST (row-column) files.

The probability plot is designed to assist qualitative testing of a variable for normal or log normal distribution. It graphs the values or the log (base 10) of the values for the variable chosen (Y axis) against their cumulative percentiles (X axis). In simplest terms, if the variable has a normal distribution, the points plotted will lie on a straight line, if the log of the value is plotted, points representing a variable with log normal distribution will lie on a straight line. Probability values between 0.00001 and 0.99999 are calculated. The prompts are listed below; respond as for the GSPUV program described previously.

ENTER GSPOST FILENAME:

LOGS BASE 10?(y/N):

ENTER PEN#, SYMBOL SIZE:

ROTATE?(y/N):

MINIMUM =

MAXIMUM =

ENTER LOWER BOUND,SCALE

Enter the lower bound for the data to be considered, then the scale in units/inch, e.g. 0,10.

After this entry the probability diagram will be drawn on the screen. As with the other graphing/statistics programs, opportunity will be provided to plot the diagram on a plotter, generate an HPGL file, and/or a GSMAP data base. Follow the prompts.

CHANGE DEVICE (y/N)?

PLOTTER,DISK?(p,d): ?

The height of the plot is determined by the range in value and the scale selected. The X dimension of the graph will be 8 inches. The sample probability plot on the next page was made from the HPGL file created by GSPPROB; the plot was not rotated, scaling points were entered as 80,320,10080,7520. The final plot is at 2/3 original size, but not otherwise edited.

### GSMAP data bases created by GSPPROB

Code 91, scale tick marks

Code 92, vertical end lines

Code 93, vertical interior lines

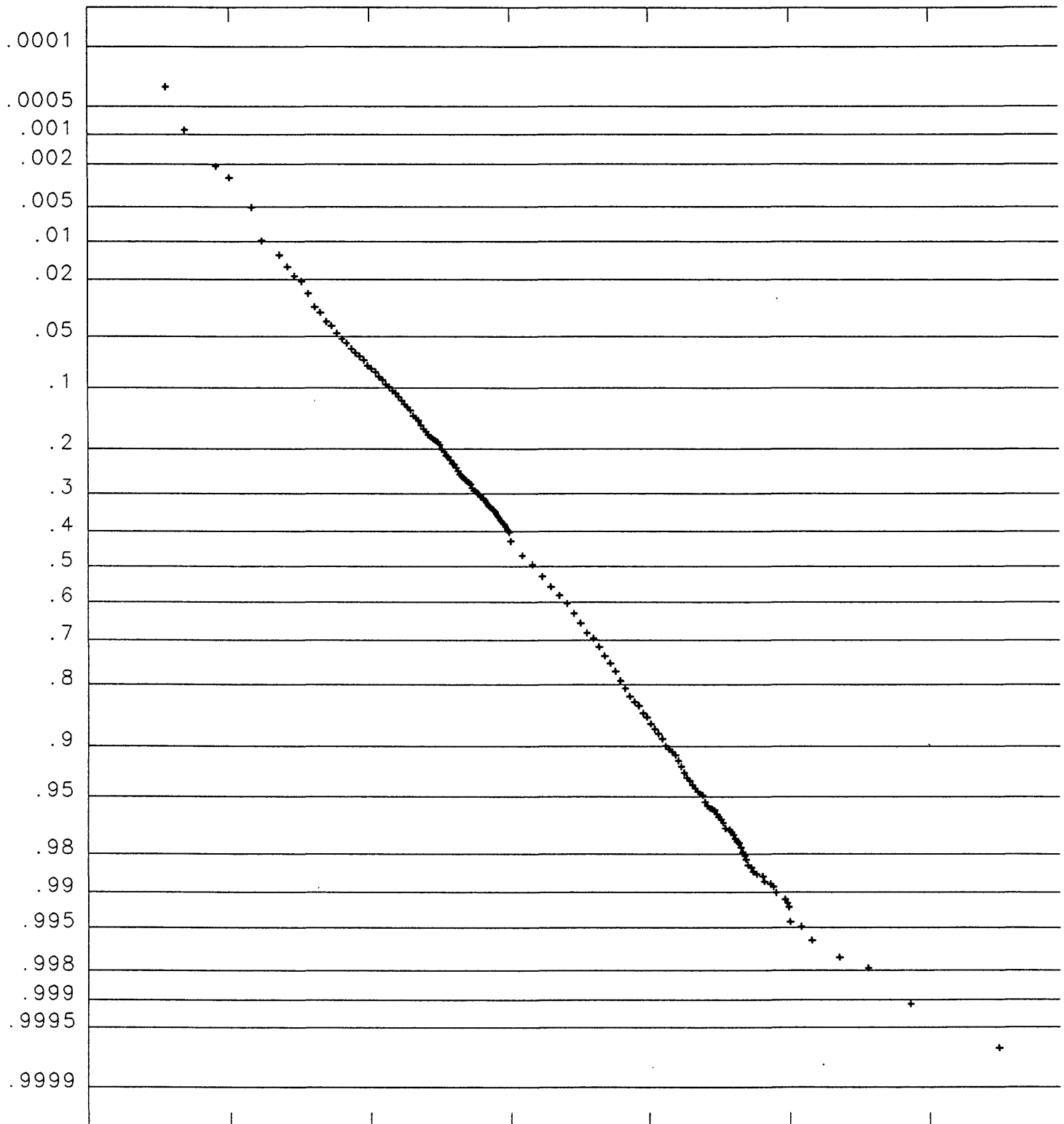
Code 94, base and top lines bounding graph

Code 300, Symbols (P1=symbol # specified, P2=symbol size specified).

Other labels must be added to the GSMAP data base by the user.

COLUMN 3

LB= .5 SCALE= .5



Example of probability plot (log base 10), 1670 samples.

## GSPXY

The GSPXY program generates an X,Y plot from two columns of a GSPOST file and provides regression statistics. It supports graphical output on the screen, to the plotter, to a disk file, or to a GSMAP data base. Options permit arithmetic, semi-log and log-log plots. The prompts are straightforward; answer each in turn.

ENTER GSPOST FILENAME:

Enter the name of the GSPOST data file e.g. LL.PRN

After this entry, the plot option is chosen:

THE FOLLOWING OPTIONS ARE AVAILABLE:

1 = X VERSUS Y

2 = X VERSUS LOG BASE 10 OF Y

3 = LOG BASE 10 OF X VERSUS Y

4 = LOG BASE 10 OF X VERSUS LOG BASE 10 OF Y

5 = EXIT

ENTER OPTION Enter the number of the option you wish to select, e.g. 2. Please remember that the log of 0 is not defined. If the data column contains a zero or a negative number, a message will remind you, but allow the session to continue so that other columns can be selected. Prompts for scale and range apply to arithmetic plots; logarithmic values are plotted at a scale of 1 = 1 inch.

The next prompts provide for selection of the columns to be used for the axes and plot parameters.

ENTER DATA COLUMN FOR X AXIS(0 TO EXIT): e.g. 2

MINIMUM VALUE = 60

MAXIMUM VALUE = 3500

ENTER START,SCALE,TICKS Enter starting value, scale (units/inch), units between tick marks, e.g. 0,2000,100

ENTER DATA COLUMN FOR Y AXIS(0 TO EXIT): e.g. 1.

MINIMUM VALUE = .5

MAXIMUM VALUE = 29

ENTER START,SCALE,TICKS Enter starting value, scale(units/inch),units between tick marks, e.g. 0,5,1

ENTER PEN#,SYMBOL,SIZE Enter the pen number, the symbol number, and the size in 1/1000 inch, e.g. 2,9,50.

After this entry the graph will be plotted on the screen.

Statistics for the regression line will be provided on the lowest line of the screen, e.g,

$r=1.435$   $b_0=0.0667$   $b_1= 0.0083$

$r$ =correlation coefficient,  $b_0$  and  $b_1$  values such that:

$$Y = b_0 + b_1 X$$

After the screen plot is complete prompts will provide opportunity for plots on a plotter or creation of a disk file, see description in the documentation for the GSPUV program.

CHANGE PLOTTING DEVICE(y/N)? If Y

PLOTTER,DISK?(p,d): ? e.g. P

If P a plot will be drawn on the plotter at the size selected. The axes will be labeled, e.g.

COLUMN 3 START=0 SCALE= 100.

If D has been chosen for output:

ENTER DISK FILENAME:

Enter the name for the HPGL file.

ENTER P1X,P1Y,P2X,P2Y (see Appendix) e.g. 80,320,10080,7520

Opportunity will be afforded to create a GSMAP data base.

WRITE OUT GSMAP DATA BASE(y/N)?

If Y

ENTER DATA BASE NAME: ? e.g. H1

ENTER TITLE(8 CHARS.): ? XY\_DIA\_23

The return to the ENTER DATA COLUMN FOR A AXIS (0 TO EXIT): prompt completes this cycle of operation.

#### GSMAP data base codes

Code 91 is used for the outline of the graph.

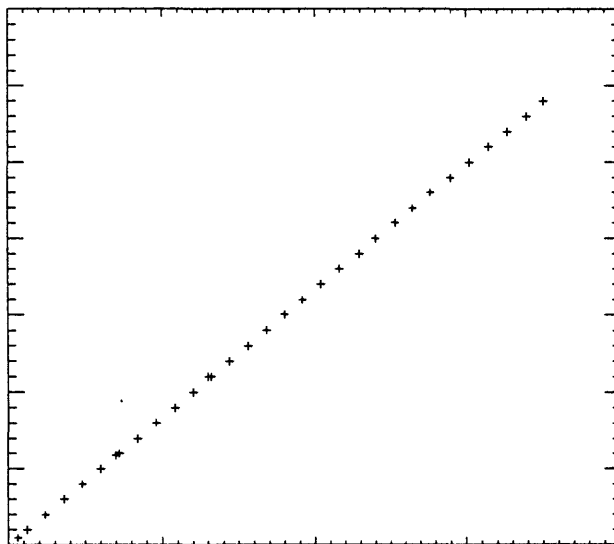
Code 92 is used for tick marks (length=0.05").

Code 93 is used for principal tick marks (length=0.1").

Code 94 is used for the regression line

Code 300 is used data points; P1=symbol number requested, P2=symbol size requested for output.

Statistical parameters and labels for axes will not be recorded in the GSMAP data base. Data for graph below drawn from a published report, reference on request.



## GSPTD

The GSPTD program generates a ternary plot from three columns selected from of a GSPOST file. It provides graphical output on the screen, to the plotter, to a disk file, or to a GSMAP data base. Prompts are straightforward; answer each in turn.

ENTER GSPOST FILENAME:

Enter the name of the GSPOST data file e.g. LL.PRN

ENTER DATA COLUMN FOR A AXIS(0 TO EXIT): Enter the number of the data column to be used for the A=left corner of the triangular graph.

ENTER DATA COLUMN FOR B AXIS(0 TO EXIT): Enter the number of the data column to be used for the B=right corner of the triangular graph.

ENTER DATA COLUMN FOR C AXIS(0 TO EXIT): Enter the number of the data column to be used for the C=upper corner of the triangular graph.

ENTER PEN#,SYMBOL,SIZE: Enter the pen number, symbol number, and symbol size for the plot, e.g., 3,1,50. After this entry the graph will be plotted on the screen. After the plot is complete prompts will provide opportunity for plots on a plotter or creation of a disk file, see description in the documentation for the GSPUV program.

HIT RETURN TO CONTINUE?

CHANGE PLOTTING DEVICE(y/N)? If Y

PLOTTER,DISK?(p,d): ? e.g. P

If P the prompt will ask:

ROTATE (y/N):? Answer Y or N depending on the plotter and the size sheet loaded.

After this response a plot will be drawn on the plotter at a size of 6 inches for each side; corners will be labeled by column, e.g. A (9). HPGL disk files will be similarly scaled.

If D has been chosen for output:

ENTER DISK FILENAME:

Enter the name for the HPGL file.

ENTER P1X,P1Y,P2X,P2Y, see p.333 and plotter documentation, e.g. 80,320,10080,7520



Opportunity will be afforded to create a GSMAP data base.  
WRITE OUT GSMAP DATA BASE(y/N)?

If Y

ENTER DATA BASE NAME: ? e.g. T1

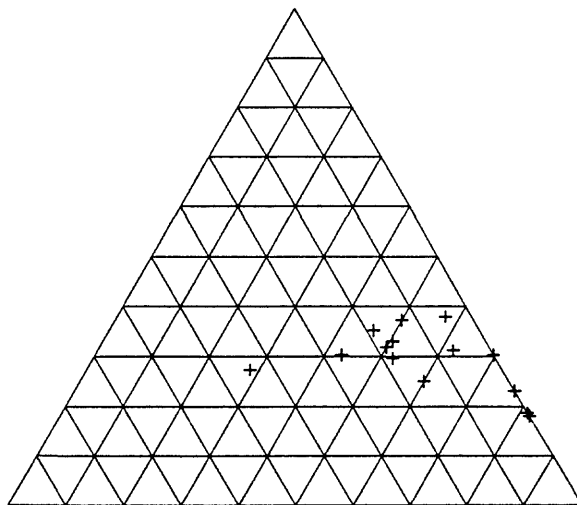
ENTER TITLE(8 CHARS.): ? **DIAGRAM1**

The return to the ENTER DATA COLUMN FOR A AXIS prompt completes this cycle of operation,  
hit the ENTER key to return to DOS.

#### GSMAP data base codes

Code 92 is used for graph lines at 10 percent intervals in A, B, and C.

Code 300 is used data points; P1 = symbol number entered, P2 = size requested.



## GSPCS

The GSPCS program provides a way to draw graphs of Z values along lines of section, using data from GSPOST format ASCII row-column files (unlimited number of rows, up to 50 data columns) using either geodetic or Cartesian coordinates.

End points for lines of section are selected on the screen using the cursor keys or a mouse from an on-screen plan view display (the first point will be the left end of the section, the second the right end). Points within a user-selected distance are projected to this line and Z values displayed as a graph along the line of section; up to 100 points can be selected. Coordinates of the end points are displayed and plotted on sections.

Two graphical output formats are supported. One uses lines to connect data points, the second plots cumulative values; in this mode patterns can be used to fill the spaces between graphical traces.

Graphical "sections" can be displayed on the screen, plotted on the plotter, written to a file in HPGL (Hewlett Packard Graphics Language), or written to a GSMAP data base.

GSPOST data files, plot control files, and projection files (if geodetic coordinates are in use) must be prepared before starting a session with GSPCS. The sample file DTEST.SEC can be used for test purposes; it requires that the data file DTEST.GSP be in the same directory.

## Operation of GSPCS

Start a session in GSPCS by entering GSPCS. After a brief display of the disclaimer screen prompts will call for entries from the keyboard. Default choices will be shown in upper case letters, other responses in lower case letters.

**ENTER PLOT CONTROL FILENAME(QUIT TO EXIT):** Enter the name of the plot control file. Plot area corners are usually best set in the plot control file.

**ENTER FILENAME OF PROJECTION PARAMETERS(TEMP.PRJ):?** Enter the name of the projection file. The screen will display files with extension .PRJ in the active area.

After this entry a message will provide information about the plot in the format shown below.

```
1.5F+07  1.5E+07      X Scale 15,000,000  Y Scale= 1:15,000,000
0,0      X Offset = 0      Y Offset = 0
N        No, don't rotate
25  1    Speed=25        Force=1
Map size(X,Y)=  8.784    6.979
```

**DO YOU WANT TO CONTINUE?(Y/n):**

If Y yes, a plan view will be displayed on screen each data point will be shown by a brown circle. A list of functions with hot keys in bright white is provided on the right side of the screen.

### Functions

#### A=SECTION

Hit A to use this option to select the line of section for the plot. Two methods can be chosen, one using the graphical interface from the screen, the second by entering the coordinates from the keyboard. The first prompt provides the choice:

**GRAPHICAL OR KEYBOARD METHOD(G/k):** Enter G or K.

If G prompts ask for entry of the first (start) and second (end) points of the section using the mouse (move then click to select) or arrow keys (move, then hit the ENTER key to select), select the two points that define the line of section.

**ENTER FIRST POINT**

**ENTER SECOND POINT**

If K prompts ask for entry of the coordinates of the points:

**ENTER FIRST POINT DD,MM,SS,C,DDD.MM,SS,C):?**

**ENTER SECOND POINT DD,MM,SS,C,DDD.MM,SS,C):?**

After the second point is selected the plan view on the screen will change to a view of the graph along the line of section. Hit any key to return to the plan view screen.

#### B=WINDOW

Hit B to select an area on the screen for a more detailed view. Follow the prompts, selecting lower left and upper right corner points. The prompts in mouse-mode will be:

**PLACE CURSOR AT LOWER LEFT CORNER-LEFT BUTTON TO MARK IT RIGHT TO EXIT**

**PLACE CURSOR AT UPPER RIGHT CORNER-LEFT BUTTON TO MARK IT RIGHT TO EXIT**

After selecting the second corner, the area shown on the screen will change to selected area for a closer look.

**C=ZOOMOUT**

Hit C to increase the area seen by 25% in both X and Y.

**D=ORIG.WIND.**

Hit D to return to the original plan view of the entire plot area.

**E=REFRESH**

Hit E to refresh the screen without changing the windowed area.

**F=SEC.DST**

Section or "selection" distance defines the maximum distance for selection of a point from the line of section. The default at the start of a session is 2. 2 km if geodetic, 2 units if Cartesian. The default distance is shown in the prompt. Increase to select points farther from the line of section. Hit F to change this distance. The operative distance is shown as in the prompt.

ENTER SECTION DISTANCE( 2.0): ?

**G=DRW GRID**

Hit G to draw a grid on the screen. The prompt will be as below if geodetic coordinates are in use:  
ENTER DELTA(DD,MM,SS): e.g. 0,15,0. Grid points will guide windowing and placement of points when selecting a line of section.

**H=ID.SITE**

Hit H to identify a particular site (data point). The prompt will change to:  
LOCATE SITE

Move the cursor to the point. If using the mouse move then click to select; if using the arrow keys, move, then hit the ENTER key to select (ENTER). The identifier of the selected point will be displayed on the bottom line of the screen, as below.

SITE ROS 1595 HIT ANY KEY TO CONTINUE

Selecting particular data points for the beginning and end of a section is an easy way to identify the line for later reference on a plan view plot; coordinates are provided on the plot for precision.

**I=CHG.DEV (change device)**

After a line of section has been selected and reviewed on the screen, hit the space bar (if you hit the P key a list of localities and Z values for the section will be printed on the printer); a prompt will be added to the screen:

DO YOU WANT TO SAVE SECTION TO A GSMAP DATA BASE?(y/N).

Answer Y to create such a data base, answer N to continue operations. After the plan view has been restored to the screen, hitting I will change the device for output. After hitting I the prompt will be:  
SCREEN,PLOTTER,DISK?(S,p,d): ?

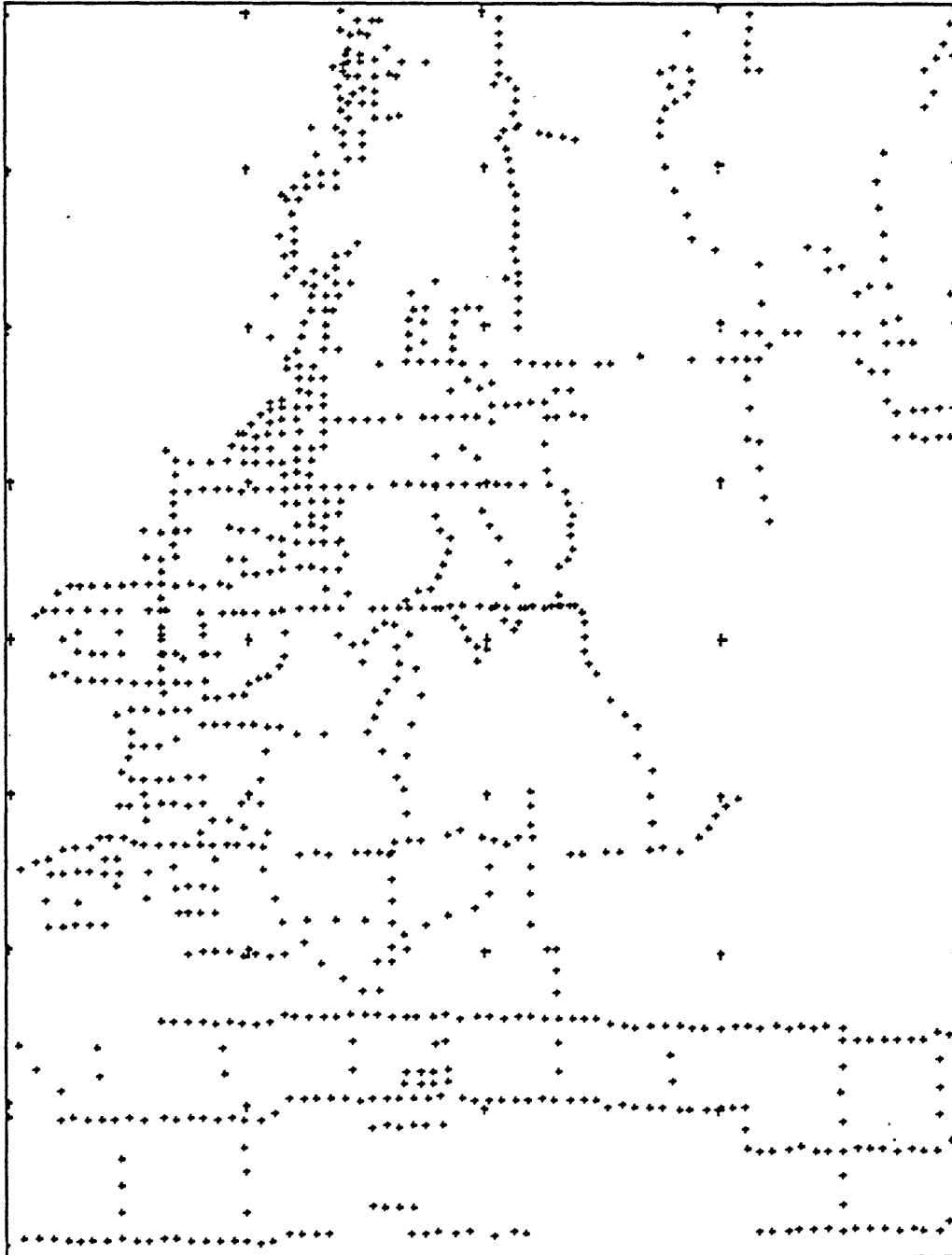
Entering P changes the output device to the plotter, D to change output to a disk file (HPGL) see pages 333 and 64 for discussion of HPGL files, prompts, and scaling points. After plotting on the plotter the default device automatically changes back to the screen.

**X=EXIT**

Hit X to exit to DOS

The next illustrations, Figures 20-25, illustrate the sequence of operations in a session with GSPCS.

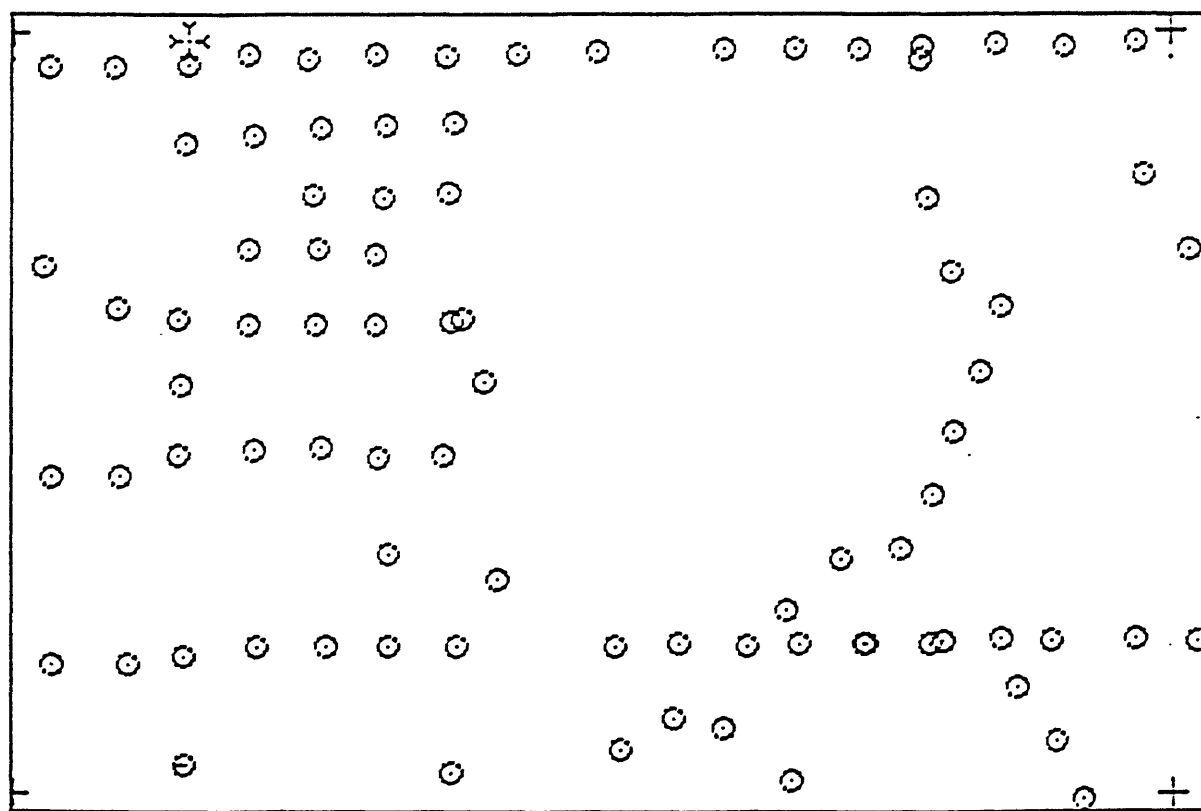
FUNCTIONS  
 A=SECTION  
 B=WINDOW  
 C=ZOOMOUT  
 D=ORG.UIND.  
 E=REFRESH  
 F=SEC.DST.  
 G=DRW GRID  
 H=ID.SITE  
 I=CHG.DEU  
 X=EXIT



USE HOT KEYS TO SELECT

ENTER DESIRED FUNCTION

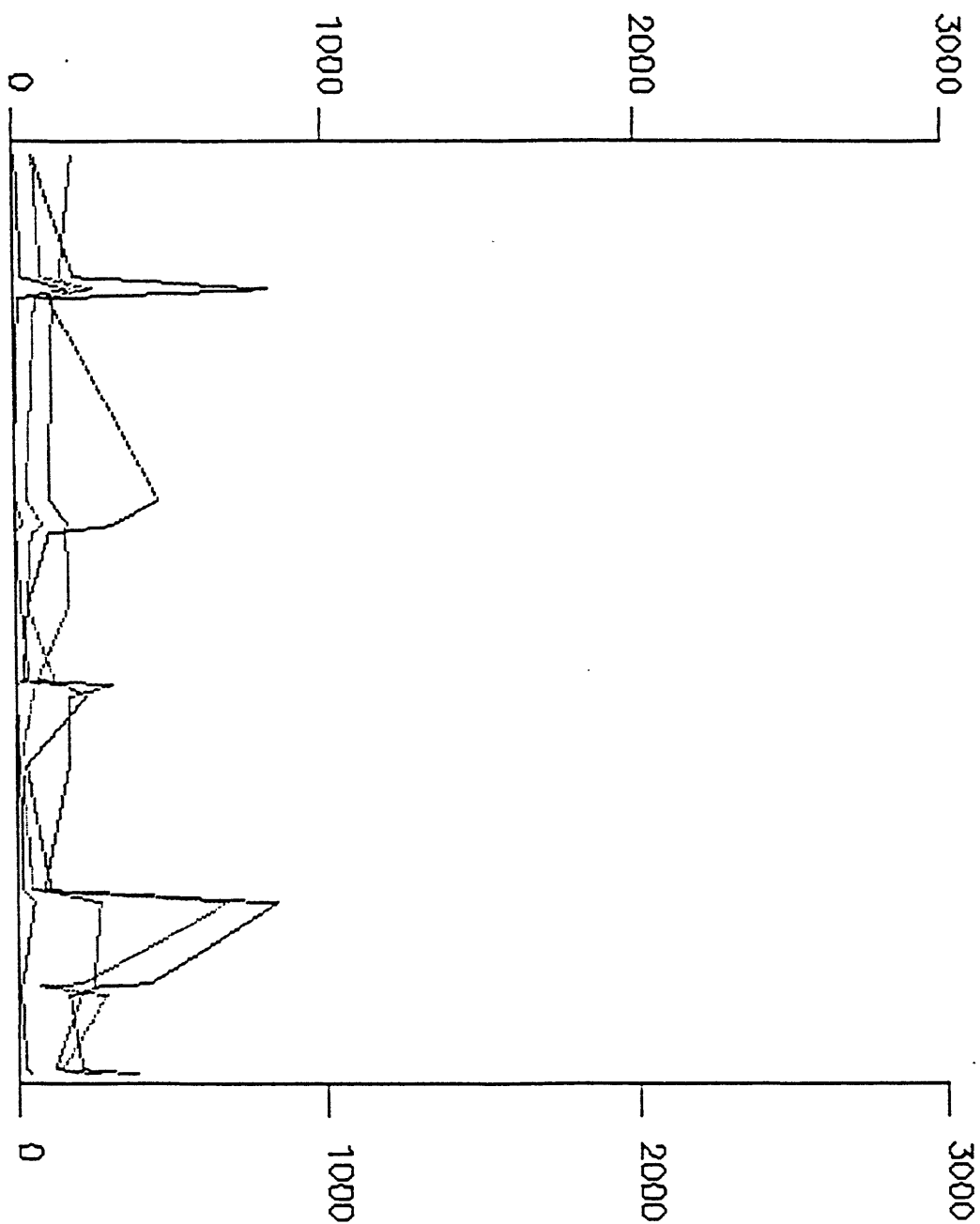
Figure 20. The first on-screen view, 1 x 2 degree sheet, 15' grid ticks plotted for reference



ENTER SECOND POINT

Figure 21 View windowed to one 15' quadrangle, 15' grid replotted

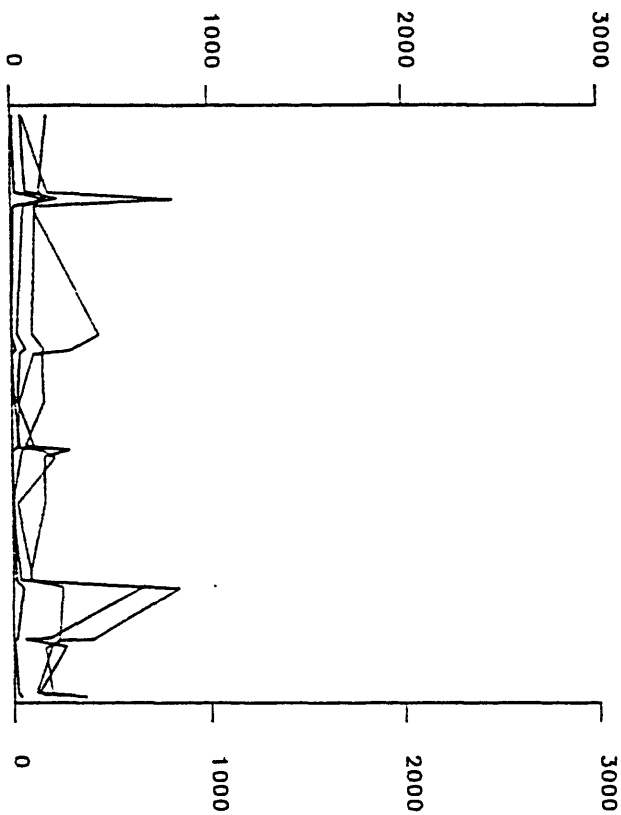
48 42 46.90N 94 59 43.58



48 42 43.71N 94 43 56.26

Figure 22. Section plotted on the screen (line mode selected).

48 42 46.90N 94 59 43.58



48 42 43.71N 94 43 56.26

Figure 23. Plot from plotter (device changed using I)



48 42 48.97N 94 59 45.14

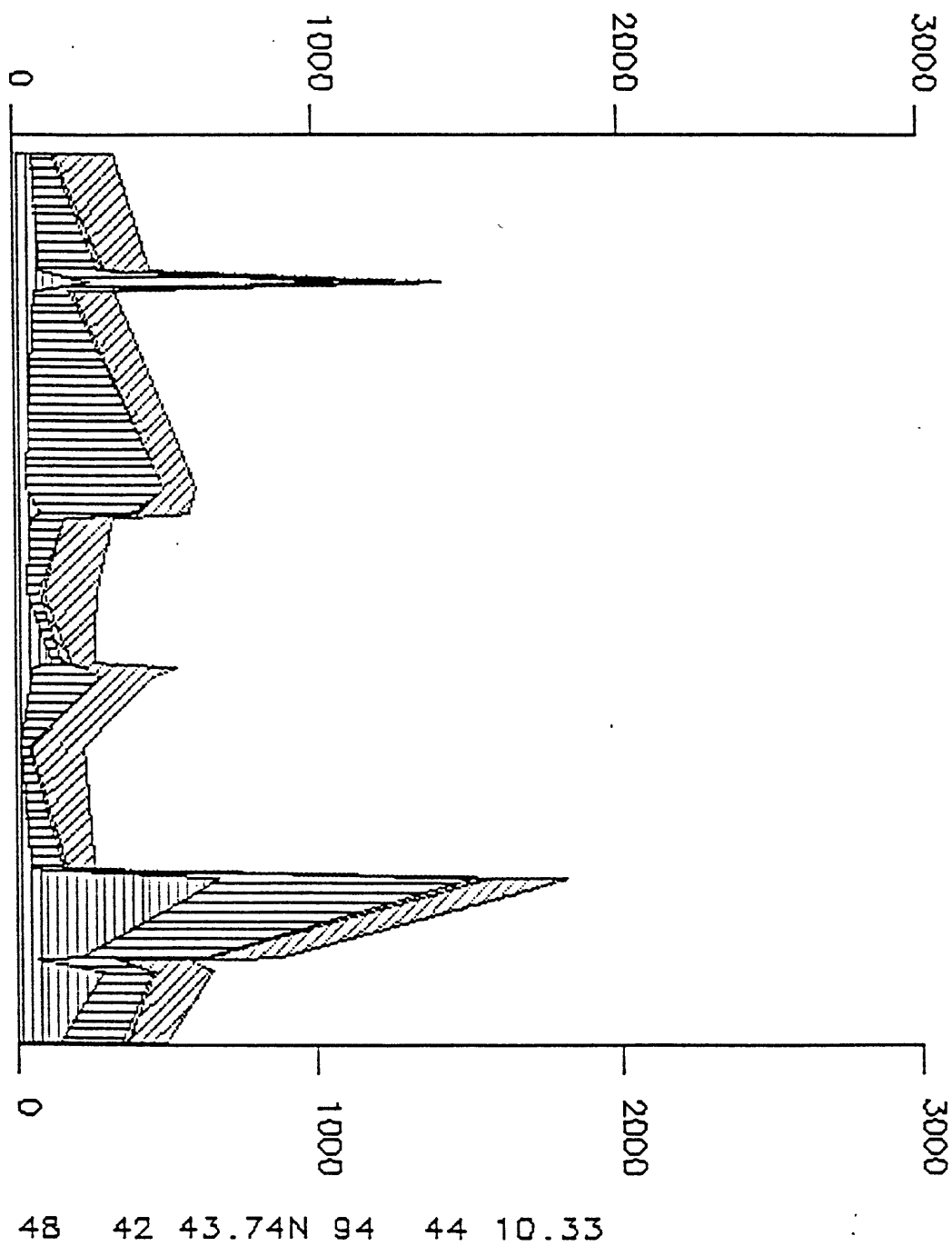
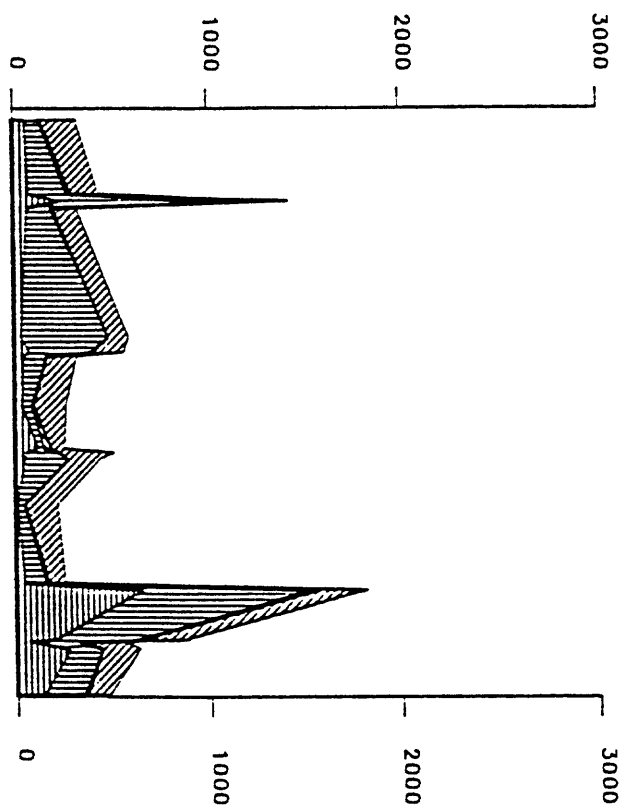


Figure 24. Section plotted on the screen, cumulative mode

48 42 48.97N 94 59 45.14



48 42 43.74N 94 44 10.33

Figure 25. Cumulative section plotted on the plotter.

## EXAMPLES OF GSPCS PLOT CONTROL FILES

The examples below are annotated to review the contents of the file. Examples have been provided for both Line and Cumulative formats.

### Line format

|                          |                                                                              |                                                                                                                                                                          |              |              |                   |                          |
|--------------------------|------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|-------------------|--------------------------|
| ANNPER.TXT               | Annotations are not a part of the file                                       |                                                                                                                                                                          |              |              |                   |                          |
| N                        | Data filename=ANNPER.TXT                                                     |                                                                                                                                                                          |              |              |                   |                          |
| 52,0,0,N,125,0,0,W       | No, don't enter corners interactively                                        |                                                                                                                                                                          |              |              |                   |                          |
| 30,0,0,N,125,0,0,W       | NW corner                                                                    | <table border="1"> <tr><td>LT=Line Type</td></tr> <tr><td>FT=Fill Type</td></tr> <tr><td>Col=Column Number</td></tr> <tr><td>Pen=Position in carousel</td></tr> </table> | LT=Line Type | FT=Fill Type | Col=Column Number | Pen=Position in carousel |
| LT=Line Type             |                                                                              |                                                                                                                                                                          |              |              |                   |                          |
| FT=Fill Type             |                                                                              |                                                                                                                                                                          |              |              |                   |                          |
| Col=Column Number        |                                                                              |                                                                                                                                                                          |              |              |                   |                          |
| Pen=Position in carousel |                                                                              |                                                                                                                                                                          |              |              |                   |                          |
| 30,0,0,N,90,0,0,W        | SW corner                                                                    |                                                                                                                                                                          |              |              |                   |                          |
| 52,0,0,N,90,0,0,W        | SE corner                                                                    |                                                                                                                                                                          |              |              |                   |                          |
| 15000000,15000000        | NE corner                                                                    |                                                                                                                                                                          |              |              |                   |                          |
| 0,0                      | XSCALE, YSCALE                                                               |                                                                                                                                                                          |              |              |                   |                          |
| N                        | XOFFSET,YOFFSET                                                              |                                                                                                                                                                          |              |              |                   |                          |
| 25,1                     | N=Don't rotate                                                               |                                                                                                                                                                          |              |              |                   |                          |
| 0,0.1,0.15               | Speed=25, Force=1                                                            |                                                                                                                                                                          |              |              |                   |                          |
| L,0,25,5,1               | Font=0,Character width=0.1",height=0.15"                                     |                                                                                                                                                                          |              |              |                   |                          |
| 1,2,0,1,.01,0            | Lines, Base=0 units, Height=25 units, Units/inch=5, Ticks at 1 unit interval |                                                                                                                                                                          |              |              |                   |                          |
| 7,7,0,1,.025,-45         | Use Col=1, Pen=2, LT=0, FT=1, Spacing=0.1", 0 degrees                        |                                                                                                                                                                          |              |              |                   |                          |
|                          | Use Col=7, Pen=7, LT=0,FT=1, Spacing=0.25. -45 degrees                       |                                                                                                                                                                          |              |              |                   |                          |

### Cumulative format

|                     |                                                                                |
|---------------------|--------------------------------------------------------------------------------|
| ANNP.TXT            | Data filename=ANNP.TXT                                                         |
| N                   | No, don't enter corners interactively                                          |
| 52,0,0,N,125,0,0,W  | NW corner                                                                      |
| 30,0,0,N,125,0,0,W  | SW corner                                                                      |
| 30,0,0,N,90,0,0,W   | SE corner                                                                      |
| 52,0,0,N,90,0,0,W   | NE corner                                                                      |
| 10000000,10000000   | XSCALE, YSCALE                                                                 |
| 0,0                 | XOFFSET,YOFFSET                                                                |
| N                   | N=Don't rotate                                                                 |
| 25,1                | Speed=25, Force=1                                                              |
| 0,0.1,0.15          | Font=0,Width=0.1",Height=0.15"                                                 |
| C,0,13500,1500,1000 | Cumulative, Base=0, Height=13500, 1500 units/inch, Ticks at 1000 unit interval |
| 1,2,0,1,.01,90      | Col=1, Pen=2, LT=0, FT=1, Spacing=.01, 90 degrees                              |
| 2,3,0,1,.01,90      | Col=2, Pen=3, LT=0, FT=1, Spacing=.01, 90 degrees                              |
| 3,4,0,1,.01,90      | Col=3, Pen=4, LT=0, FT=1, Spacing=.01, 90 degrees                              |
| 4,5,0,1,.01,90      | Col=4, Pen=5, LT=0, FT=1, Spacing=.01, 90 degrees                              |
| 5,6,0,1,.01,90      | Col=5, Pen=6, LT=0, FT=1, Spacing=.01, 90 degrees                              |
| 6,7,0,1,.01,90      | Col=6, Pen=7, LT=0, FT=1, Spacing=.01, 90 degrees                              |
| 7,8,0,1,.01,90      | Col=7, Pen=8, LT=0, FT=1, Spacing=.01, 90 degrees                              |
| 8,9,0,1,.01,90      | Col=8, Pen=9, LT=0, FT=1, Spacing=.01, 90 degrees                              |
| 9,10,0,1,.01,90     | Col=9, Pen=10, LT=0, FT=1, Spacing=.01, 90 degrees                             |
| 10,11,0,1,.01,90    | Col=10, Pen=11, LT=0, FT=1, Spacing=.01, 90 degrees                            |
| 11,12,0,1,.01,90    | Col=11, Pen=12, LT=0, FT=1, Spacing=.01, 90 degrees                            |
| 12,13,0,1,.01,90    | Col=12, Pen=13, LT=0, FT=1, Spacing=.01, 90 degrees                            |

## GSMAP DATA BASES FROM GSPCS

GSMAP codes 91 and 92 are used for the frame and the tick marks respectively.  
GSMAP code 192 is used for label points

### Line mode sections

GSMAP codes for lines are equal to the number of the data column

### Cumulative mode

GSMAP codes for polygons are 400 plus the number of the data column

A sample GSMAP plot control file useful with output from GSPCS and other GSMAP output from programs in this volume) is printed below

```
Y
1,1
0.65,2.0
N
Y
8,2
91,2,0,0, "FRAME"
92,2,0,0, "TICK MARKS"
93,3,0,0,
94,2,0,0,
1,1,0,0, "LINES COL 1"
2,2,0,0, "LINES COL 2"
3,2,0,0, "LINES COL 3"
4,2,0,0, "LINES COL 4"
5,2,0,0, "LINES COL 5"
6,2,0,0, "LINES COL 6"
7,2,0,0, "LINES COL 7"
192,1,30,40, "INDEX LABELS VALUES FROM P1"
x.x,0
1,0
401,1,0,0, "DIAGONAL PATTERN COLUMN 1"
4,0.050,0,1,0
402,2,0,90, "DIAGONAL PATTERN COLUMN 2"
4,0.050,-45,2,0
403,3,0,0, "DIAGONAL PATTERN COLUMN 3"
4,0.050,45,3,0
404,4,0,0, "DIAGONAL PATTERN COLUMN 4"
4,0.050,-60,4,0
405,5,0,0, "DIAGONAL PATTERN COLUMN 5"
4,0.050,60,5,0
406,6,0,0, "DIAGONAL PATTERN COLUMN 6"
4,0.050,-30,6,0
500,1,0,0, "ADDED LABELS"
X.RU,0
0,0,0,0, "END OF PLOT FILE"
SAMPLE CARTESIAN COORDINATE PLOT FILE FOR GSMAP DATA BASES FROM GSPCS
```

The process of creating a contour map starting with a set of "Z" values at random locations specified using of latitude and longitude coordinates has typically included many steps, each requiring a separate program.

1. Project the latitude, longitude locations to X,Y Cartesian coordinates.
2. Compute the minimum and maximum values for the X, Y, and "Z" values.
3. Run a gridding program to compute a grid of z values.
4. Run a contouring program to produce a contour map.
5. If the contour map indicates problems with the input data, run a posting program to post the input data.
6. Overlay the posting plot and the contour plot and identify each incorrect data value.
7. Edit the input data file and correct the values.
8. Go back to step 1.

GSPDC and GSPGRCO provide a direct process to:

- Project the latitude longitude coordinates to a chosen Cartesian system, coordinates in kilometers, compute default values for minimum and maximum X, Y, and Z, and contour values.
- Grid the data
- Contour the gridded data
- Draw the grid, data point locations, and contour lines on the screen.
- Allows the user to change the minimum, maximum, and interval for contour interval and redraw the display without regridding the data
- Allows the user to change the XMIN, XMAX, YMIN, YMAX, and grid interval, regrid and recontour the data.
- Enlarge areas on the screen (window) where data appear incorrect, identify by number, X, Y, and Z the data point locations that were used in computing a particular grid value.

By selectively windowing all areas, the user should be able to identify all of the problems with the input data, so that after exiting and editing the data file once, the second run of GSPGRCO should produce a display using the best setting of the input values, and of the gridding, and contouring parameters.

- The grid can be saved to an ASCII file
- The contour lines can be written directly into a GSMAP data base
- The contour level and x,y coordinates of each contour lines can be written to an ASCII file.

The last step is to plot a contour map using GSMAP or another graphics program enabling plotting, editing, and smoothing of the lines by splining. Preliminary tests reported to us indicate that the time of processing can be reduced to a fourth that of traditional methods.

Those who use other gridding algorithms and different contouring programs may find that GSPGRCO and GSPDC assist in identifying spurious data points, and thus in verification and correction of a data set. The two programs use different algorithms. The nature of the data set and user acumen will determine the one to favor.

The GSPDC program uses Delaunay triangles (see Glossary), interpolates positions of contour values and provides a way of creating regularly spaced grid points and contours developed from the resulting grid.

The GSPGRCO program uses a more conventional approach, employing a 1/distance squared algorithm to obtain Z values for grid points. Either will generate a surface of minimum curvature and generate contours based on this surface. Both programs build an output data base in GSMAP format. Both programs contain a review procedure to facilitate identification of anomalous data points, be they real anomalies or artifacts of error.

Which program should you use ?

GSPDC requires a set of input points in X,Y,Z space that are then joined by non-intersecting straight line segments to form a network of planar triangular facets to build a complete surface by interpolation between data points. The grid formed from these facets has regular (user defined) X and Y coordinates and Z values determined by linear interpolation between data points. No extrapolation, no magic, until gridding and minimum-curvature algorithms are applied. There are no unexpected boundary effects due to unseen mathematical manipulations. The program will balk at duplicate points, and is limited to about 1,000 data points.

GSPGRCO will operate with more points (limits are on the size of the grid not on the number of input data points). The program can produce anomalous contours, especially when used with minimum curvature smoothing.

Use the contouring program best suited to your data set and the option in the program that fits best. Do use GSPOST to plot maps showing the values of data points so that you can become familiar with the data set. Do check data before contouring using either program.

All gridding and contouring programs make assumptions. The function to be gridded must be single valued at all points in the region, the function must be continuous within the region, and the function should be positively autocorrelated over some length scale at least as large as the typical spacing between observation points (adapted from Smith and Wessel, 1990).

If in doubt, don't.

## GSPDC

The GSPDC program is a contouring and gridding system for IBM compatible microcomputers that takes data from a digital data file in GSPOST row-column format (geodetic or Cartesian coordinates) limited to approximately 1,000 randomly spaced data points.

GSPDC provides the following:

1. Generation of Delaunay triangles (see Glossary p.356.
2. Contouring from the triangulated network based on linear interpolation within the set of Delaunay triangles.
3. A convenient way of reviewing values of data points in context with graphical display of contour lines. Anomalous points can be identified easily to assist error correction as well as to identify true anomalies.
4. A convenient way of reviewing and changing contouring parameters, such as contour interval, so that optimum choices for data display can be selected.
5. Export of the contour lines to a digital data base in GSMAP format.
6. Generation of an interpolated grid based on the Delaunay triangles that can be used to generate contour maps using this or other programs.
7. Export of contours based on this grid to GSMAP data base
8. A trim polygon defined by up to 50 data points can be used to limit the field of points considered by the program.

### Methods of calculation

Delaunay triangles (alternately called Sukkar triangles) divide the data area into a series of triangles with vertices at data points for natural neighbors, to form a system of triangles including all data points. The shape and spacing of the triangles depends on the distribution of data points.

Contour line segments connect points calculated by interpolation along the sides of the triangles that have the same contour elevations in a single Delaunay triangle. These line segments are generated for each triangle for all contour values selected. The set of line segments makes up a system of contours (calculated by interpolation between data points) for the data set without extrapolation outside of the triangles.

### Methods of gridding and contouring

Each Delaunay triangle defines a plane in X, Y, Z space. The system of triangles defines a surface for the entire data area. The Z values for each point in a set of grid points regularly spaced in X and Y (square or rectangular array) can be calculated from the sloping surface representing the Delaunay triangle at that grid point. The resulting regular grid can be written to a file and contoured.

### Effects of gridding and contouring

The next several figures illustrate the effects of different treatments using a single small data set provided with this program in the file DTEST.GSP. This data set was published by Davis (1973) to illustrate the effects of different methods of contouring and gridding data. This file is used here in a similar manner. Figures 1-9 are taken from this data, all have a 10 foot contour interval. The data points and data values that are plotted on figures 26-30 were added to GSMAP data bases using the GSMUTIL program.

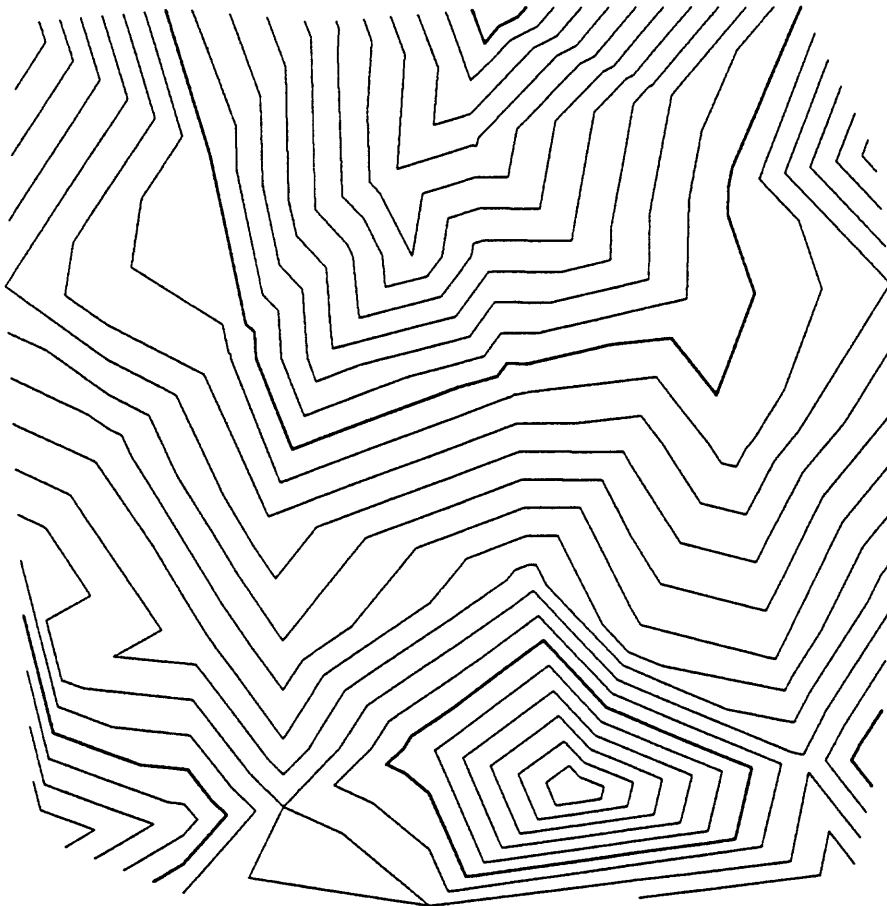
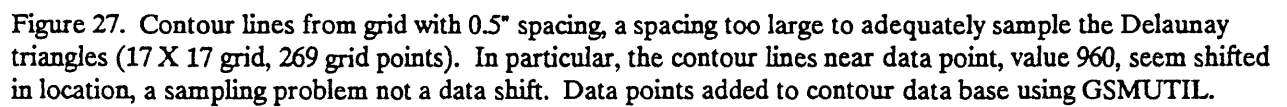


Figure 26. Contour line segments from triangulated net.





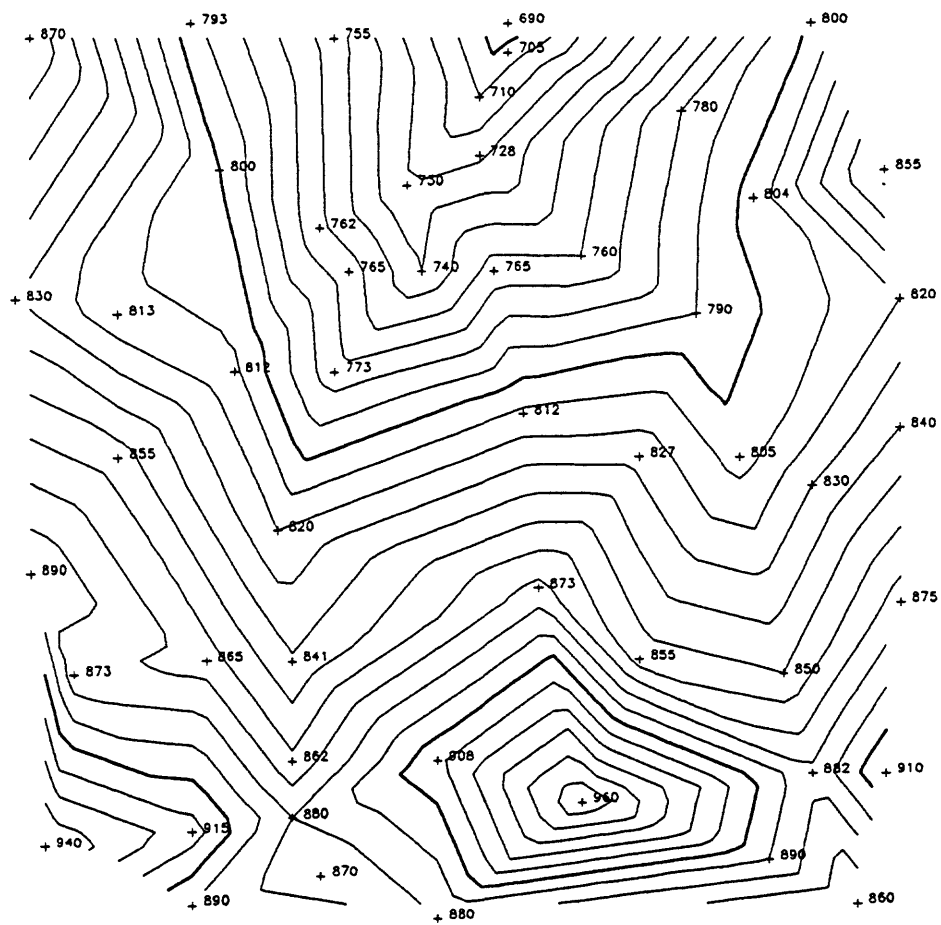


Figure 28. Contour lines from grid with 0.1" spacing, a spacing that better samples the Delaunay triangles (81 X 81 grid, 6561 grid points). Data points added using GSMUTIL.

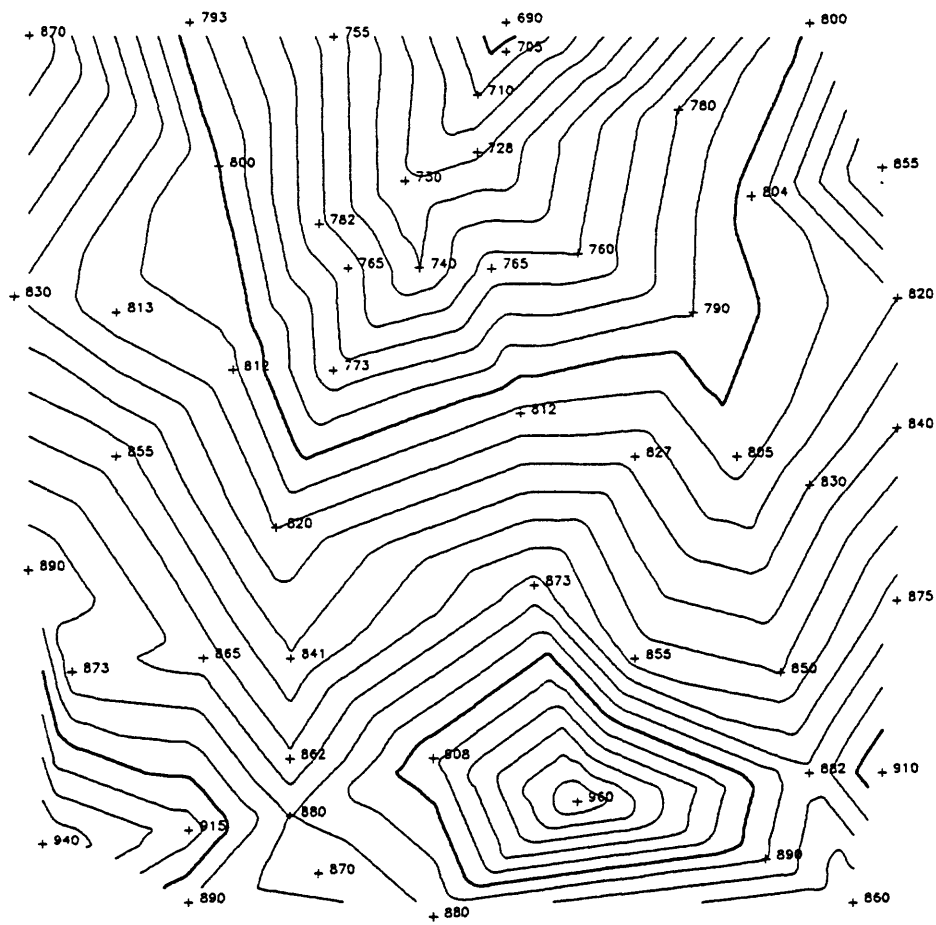


Figure 29. Grid 0.1" spacing as in fig 28, lines splined (GSMAP code group 600-699. Data points added using GSMUTIL.

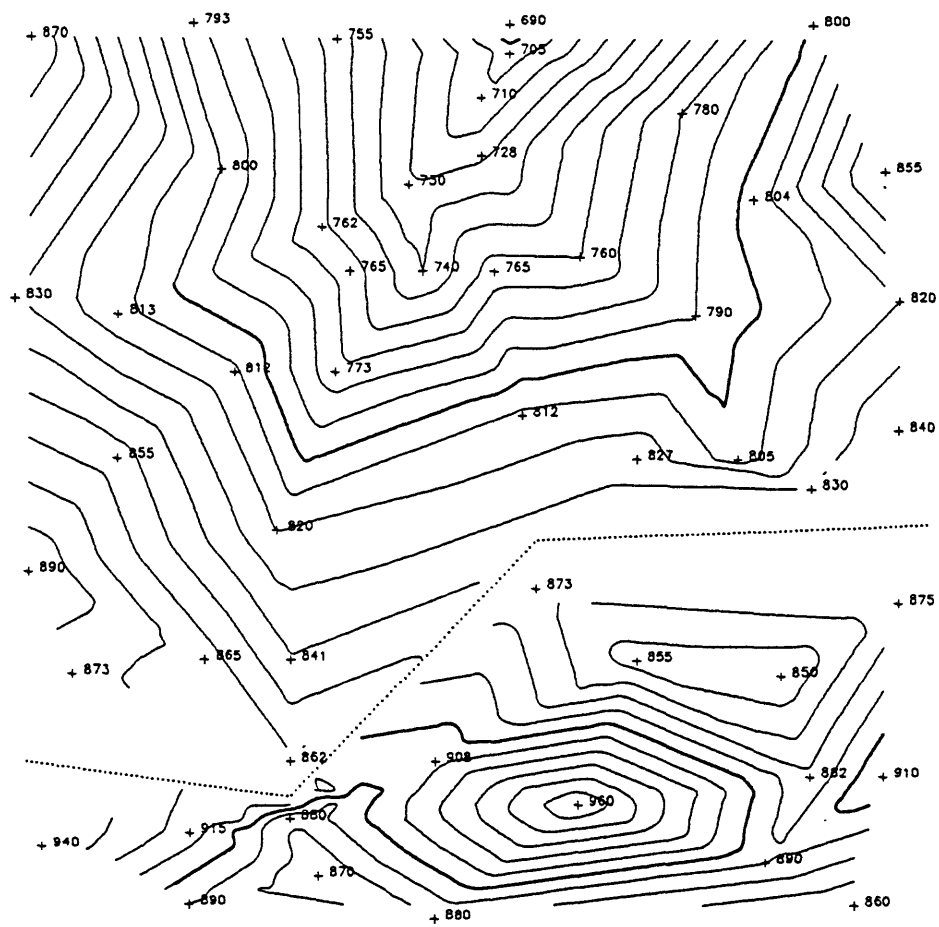


Figure 30. Polygons chosen to bound data points at dotted line. Contour lines generated using two passes through the data, then merged and data points added using GSMUTIL to merge data bases; contour lines were splined (GSMAP).

## OPERATION OF GSPDC

Start the program by entering GSPDC from the keyboard of the computer. The program will request entries; respond to each prompt in turn. The responses to prompts in bold letters below are appropriate to the data file DTEST.GSP supplied with this release.

**ENTER INPUT FILENAME:**

Enter the name of the data file e.g. **DTEST.GSP**

If you are working with geodetic coordinates, a list of .PRJ files in the active area will be displayed with a prompt asking for entry of the name of the projection parameter file (message and prompt skipped if Cartesian coordinates are being selected).

**ENTER FILENAME OF PROJECTION PARAMETERS: ?** Enter the name of the file.

**DO YOU WANT TO USE A POLYGON TRIM FILE? (y/N):** Enter Y or N

If yes, a prompt will be shown (prompt skipped if N was entered above).

**ENTER FILENAME FOR POLYGON TRIM** Enter the name of the file.

If yes, a prompt will be displayed (prompt skipped if N was entered above).

**DO YOU WANT TO INCLUDE POINTS OUTSIDE THE POLYGON BORDER? (Y/N):**

Enter Y or N. The Y choice permits use of data in the data base to the limit of appropriate Delaunay triangles, but with contours and grid trimmed to the limits of the polygon. The N choice allows restriction of the triangulation process to data points inside the trim polygon, as for example to use data from one side of a fault and not the other.

The next prompt requests entry of the number of the data column for contouring from the data file.

**ENTER SELECTED COLUMN:**

Enter the number of the data column to be used. e.g. 1

**READING DATA STANDBY**

**CHECK FOR DUPLICATES? (Y/n):** Y

The program will check for duplicate data points, identical coordinates, but perhaps with different Z values. No duplicate points are allowed by the algorithm creating the triangulated network. The screen will next display data about the data file, with default values for certain parameters to be reviewed. If you know that there are no duplicate points, as for example with a data file that has been checked previously, the N response will save the time of checking. To quote Amahl's mother, "Are you sure, sure, sure". The only penalty is a sudden exit to DOS.

| ORIGINAL DATA VALUES |         |            |         |
|----------------------|---------|------------|---------|
| NUMBER OF POINTS= 55 |         |            |         |
| X MINIMUM=           | 0.200   | X MAXIMUM= | 6.300   |
| Y MINIMUM=           | 0.000   | Y MAXIMUM= | 6.200   |
| Z MINIMUM=           | 690.000 | Z MAXIMUM= | 960.000 |

| CURRENT CONTOUR VALUES |         |           |        |
|------------------------|---------|-----------|--------|
| MIN.CONTOUR=           | 700.000 | INTERVAL= | 26.000 |
| MAX.CONTOUR=           | 960.000 |           |        |

The next set of prompts provide opportunity to change the current contour values. Default values (hit the ENTER key) are the values in the box.

ENTER MINIMUM CONTOUR VALUE Enter the minimum contour value for the data set **700**

ENTER MAXIMUM CONTOUR VALUE Enter the maximum contour value for the data set **1000**

ENTER DELTA CONTOUR VALUE Enter the contour interval desired **10**

The values entered will be displayed in the box, changed to reflect the entries just made, as shown below.

| CURRENT CONTOUR VALUES |          |           |        |
|------------------------|----------|-----------|--------|
| MIN.CONTOUR=           | 700.000  | INTERVAL= | 10.000 |
| MAX.CONTOUR=           | 1000.000 |           |        |

ARE THE PARAMETERS OK?(Y/n): ?

After verifying that the parameters are correct by entering Y, the screen will change to the view shown in the Fig. 31. Hit the space bar to continue operations. The prompt will change to:

RESET CONTOUR VALUES? (y/N): ?

The value for the "radius" displayed on the screen is a search parameter used in the review process akin to the identification distance used in other GS series programs.

Opportunity is now afforded to check and change parameters if you choose to do so, then the prompt will change to:

REVIEW? (y/N): ?

If you respond Y a review procedure provides opportunity for a closer look at pieces of the data set to check, beginning with the screen shown on Fig. 32.

PARAMETERS

-----  
 XMIN= 0.200  
 XMAX= 6.300  
 YMIN= 0.000  
 YMAX= 6.200  
 CMIN= 700.000  
 CMAX= 1000.000  
 CONT.INT= 10.000  
 RADIUS = 0.305

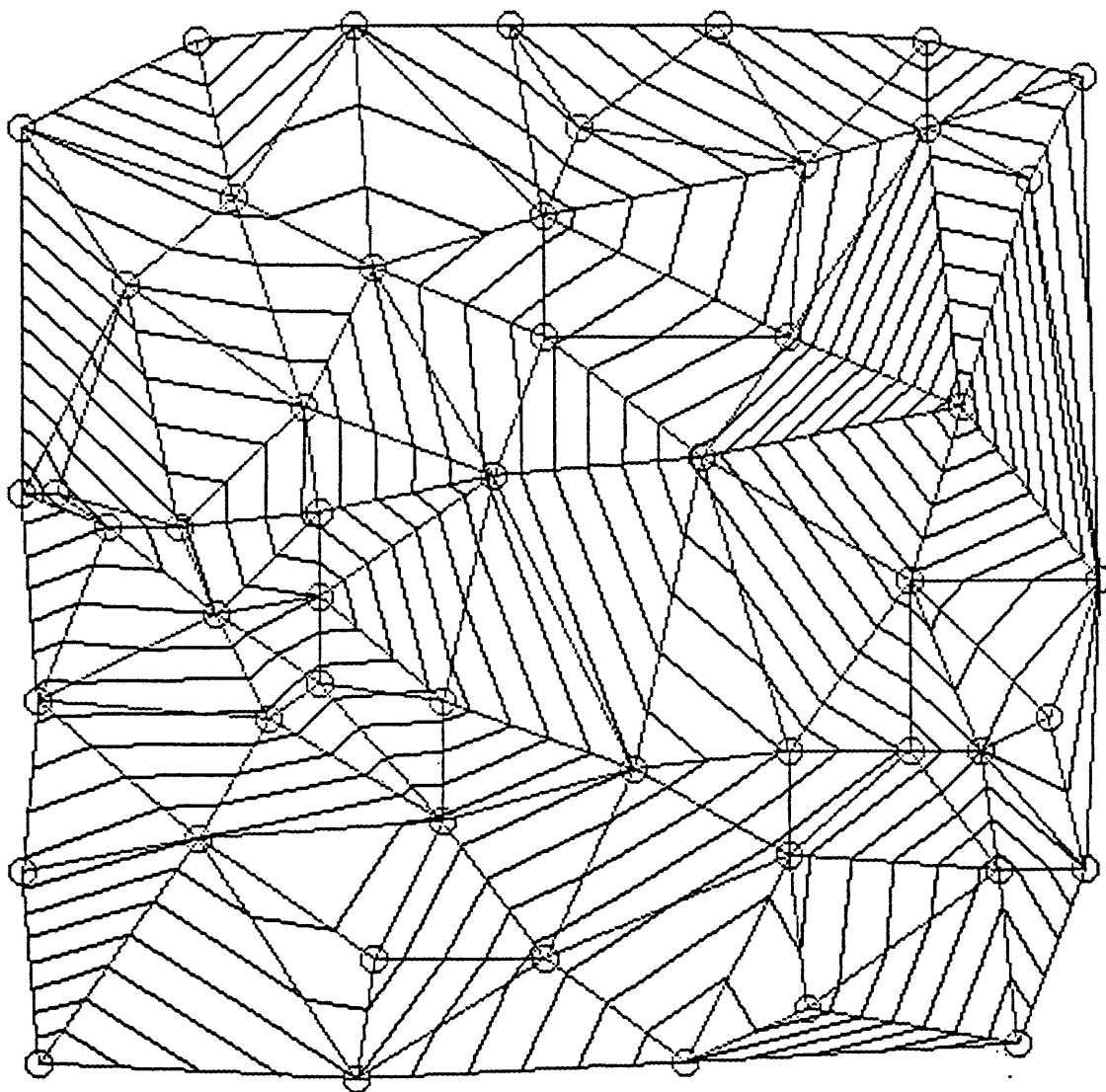


Figure 31. Graphical display, a first look through the eyes of the raster display. Delaunay triangles in gray, triangulated contour segments in white, circles in brown mark data points, contour parameters are displayed.

HIT SPACE BAR TO CONTINUE

**FUNCTIONS**  
**A=IDENTIFY**  
**B=WINDOW**  
**C=RESTORE**  
**D=CON.LINE**  
**E=CHG. RAD**  
**X=EXIT**

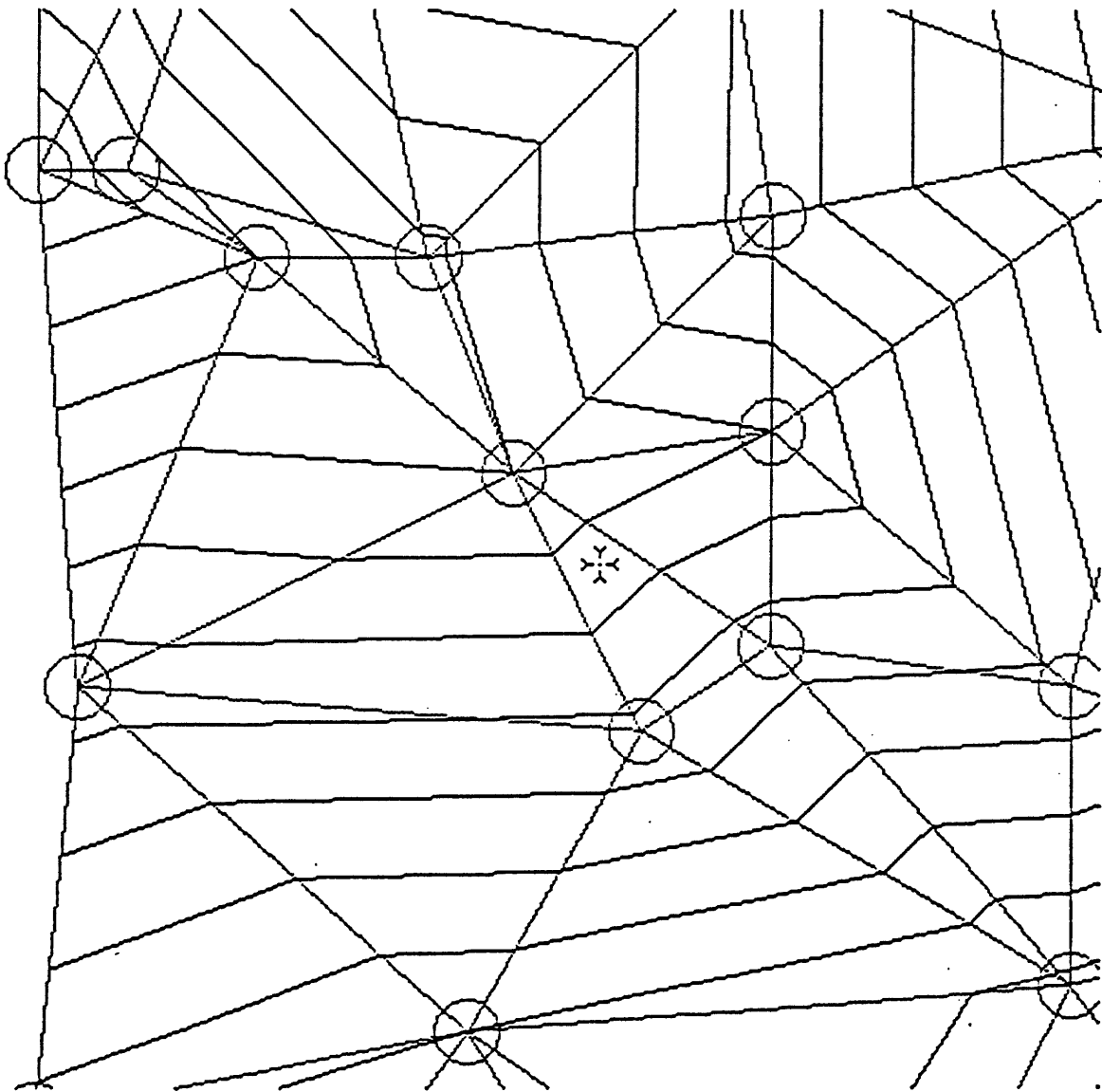


Figure 32. Review screen, functions are selected by hitting hot keys.



## Review screen functions

Options A, B, and D require pointing on the screen. This can be done using a Microsoft-compatible mouse if available and if mouse-driver software has been installed, then clicking the left key to select, or by using the arrow keys on the numeric keypad (Num Lock must be OFF) to move a + cursor to the point, then selecting the point by hitting the ENTER key.

**Hit A=IDENTIFY** to identify a data point.

Move the cursor to the point, then select it. Values for the point will be displayed on the bottom line of the screen.

**Hit B=WINDOW** to window to an enlarged view of a portion of the screen.

Move the cursor to the lower left corner of the window, select it, then move the cursor to the upper right corner of the window, then select it; the enlarged view will be seen on the screen.

**Hit C=RESTORE** to return to the original view.

**Hit D=CON.LINE** to identify the value for a contour line

Move the cursor to the line, then select it. The contour value will be displayed on the bottom line of the screen.

**Hit E=CHG.RAD** to change the search radius.

Enter the revised value.

**Hit X=EXIT** to leave this screen, then continue operation of the program.

The next prompts are related to the preparation of a GSMAP data base containing the triangulated contour line segments.

WRITE CONTOUR LINES TO A GSMAP DATA BASE(Y/N): ? Enter Y=yes or N=no.

If Y=yes, the next prompts will be the same as those for starting GSMAP data bases. This data base will have the triangulated contours, as previously displayed on the screen.

ENTER OUTPUT DATA BASE NAME: Enter the name for the GSMAP data base.

ENTER OUTPUT TITLE(16 MAX.): Enter the title for the GSMAP data base.

If Cartesian coordinates are in use, the next prompt will be:

OPTIONAL METHODS FOR SPECIFYING DATA BASE CORNERS

- 1 SPECIFY UPPER RIGHT CORNER(X,Y)
- 2 SPECIFY LOWER LEFT(X,Y), UPPER RIGHT(X,Y)
- 3 ALL FOUR CORNERS

ENTER OPTION

Enter 1,2, or 3.

If 1

ENTER UPPER RIGHT CORNER (X,Y) e.g. 8,8

If geodetic coordinates are in use, the next prompt will be:

TYPES OF MAPS

- 1 - 7 1/12 MINUTE
- 2 - 15 MINUTE
- 3 - 30 MIN LAT x 1 DEG LONG
- 4 - 1 DEG LAT x 2 DEG LONG
- 5 - OTHER

ENTER TYPE:

Enter the number corresponding to the corners to be used for the data base. If type 1, 2, 3 or 4 is selected the following prompt will be seen:

ENTER LAT/LON OF NORTHWEST CORNER:

DD,MM,SS,C,DDD,MM,SS,C:

The format for entry of map corners in geodetic format is as follows: DD,MM,SS,C,DDD,MM,SS,C: Latitude in degrees, minutes, seconds, Compass direction (N or S), Longitude in degrees, minutes, seconds, Compass direction (W or E), with commas separating the entries, for example 38,30,0,N,106,15,0,W. For Compass direction use N for north latitude, S for south latitude, W for west longitude, E for east longitude. Entry of the required coordinates for the northwest corner of the data base area will return the program screen to the Main Menu; coordinates for the other three corners of the data base will be computed by the program.

If type 5 is selected the following prompts will be seen, requesting entry of the latitude/longitude coordinates of the four corners of the map:

ENTER LAT/LON OF NORTHWEST CORNER  
DD,MM,SS,C,DDD,MM,SS,C:

ENTER LAT/LON OF SOUTHWEST CORNER  
DD,MM,SS,C,DDD,MM,SS,C:

ENTER LAT/LON OF SOUTHEAST CORNER  
DD,MM,SS,C,DDD,MM,SS,C:

ENTER LAT/LON OF NORTHEAST CORNER  
DD,MM,SS,C,DDD,MM,SS,C:

Completion of entry of the coordinates in required form (commas separating the entries for degrees, minutes, seconds, and compass direction), calls for entry of the code to be used for the contour lines.

ENTER GSMAP CODE FOR PRIMARY CONTOUR LINES (1-99): Enter the code desired for the primary contour lines.

ENTER GSMAP CODE FOR SECONDARY CONTOUR LINES (1-99): Enter the code desired for the secondary (other) contour lines.

ENTER NUMBER OF INTERVALS BETWEEN PRIMARY CONTOURS: Enter the number of contour intervals between primary contours. The lowest value selected will be a primary contour, then values above it at the separation selected.

After preparation of the GSMAP data base, or answering N to decline preparation, the next prompts are related to preparation of a grid, if desired, for use by this or other contouring programs.

PREPARE GRID? (y/N): ? If Y=yes, the next prompt will request the name of the file to contain the grid data. If you enter N the program's function is complete and operation will return to DOS. You must prepare a grid at this point if you wish to prepare contours based on a grid later. Values for the minimum and maximum values needed for the grid will be displayed on the right side of the screen to assist making appropriate choices.

ENTER OUTPUT FILENAME: ? Enter the name of the file.

ENTER OUTPUT TITLE(56 MAX.): ? e.g. OUTPUT GRID DTEST

ENTER XMIN,XMAX,DX: ? e.g. 0,6.4,0.1

ENTER YMIN,YMAX,DY: ? e.g. 0,6.4,0.1

Enter grid interval:? e.g. 5

The program will calculate the grid values, then display contours on the screen, ask if review is desired, and provide opportunity to save the grid, and to write a GSMAP data base using the gridded values. Another iteration allows application of a minimum curvature algorithm to smooth the grid values. If this option is selected a prompt will ask:

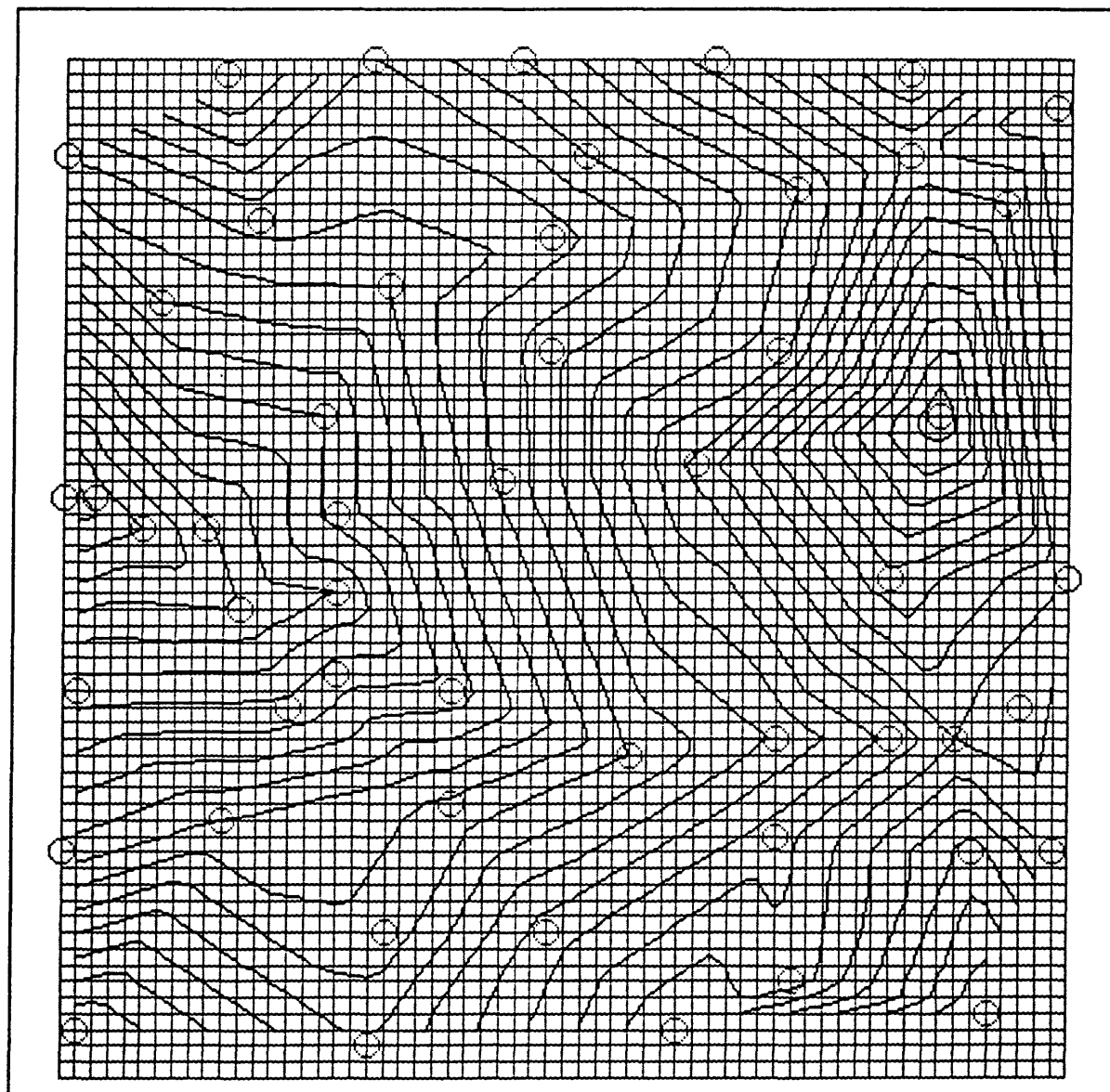
ENTER ITERATION LIMIT VALUE: ? Enter the iteration limit selected. The default (0) is 10 percent of the value selected for the contour interval. A value 1 to 10 percent of the contour value is generally appropriate.

PARAMETERS

```

-----
XMIN= 0.000
XMAX= 6.300
YMIN= 0.000
YMAX= 6.200
CMIN= 700.000
CMAX= 960.000
CONT.INT= 10.000
RADIUS = 0.305

# OF ROWS= 63
# OF COLS= 64
  
```



WRITE CONTOUR LINES TO GS MAP DATA BASE(y/N): ?

Figure 33. Contours based on regular grid displayed were generated by interpolation within the network of Delaunay triangles. Grid parameters shown on right side of screen.

After display of the grid and contours derived from it Fig 33, with or without the smoothing of the minimum curvature algorithm, the user can choose to write the contour lines to an output GSMAP data base. WRITE CONTOUR LINES TO A GSMAP DATA BASE(Y/N): ? Enter Y=yes or N=no.

If Y=yes prompts will be the same as before.

This completes one cycle of program operation. If the prompt below is answered Y another cycle begins, if N operations return to the DOS prompt.  
PROCESS ANOTHER SET OF DATA(Y/N): ?

### Trim files for GSPDC

Files used as trim polygons for GSPDC to restrict the data points used for contouring and the limits of grids are easily created using GSMAP (Option 3 digitize) or GSMEDIT (digitize mode). Digitize the needed points as a single closed polygon with 50 points or less, then convert the points to an ASCII file using GSMU-TIL Option 2. Header records on these ASCII files must then be deleted using a text editing program. Examples of trim files created in this way are printed below.

Example of trim file using Cartesian coordinates

|           |          |
|-----------|----------|
| -0.053647 | 6.525016 |
| 0.081958  | 0.694024 |
| 2.747060  | 0.875125 |
| 3.158135  | 1.655938 |
| 6.825136  | 1.258551 |
| 6.805622  | 6.635200 |
| -0.053647 | 6.525016 |

Example of trim file using geodetic coordinates

|           |             |
|-----------|-------------|
| 39.882951 | -106.182784 |
| 39.910734 | -106.144701 |
| 39.907017 | -106.099858 |
| 39.907060 | -106.099619 |
| 39.907126 | -106.099405 |
| 39.868669 | -106.081187 |
| 39.868434 | -106.081025 |
| 39.868361 | -106.080812 |
| 39.836740 | -106.106951 |
| 39.836604 | -106.107167 |
| 39.839059 | -106.142586 |
| 39.848433 | -106.159741 |
| 39.882951 | -106.182784 |

## GSMAP data bases created by GSPDC

The codes selected by the user as a part of the creation of GSMAP output data bases should be in the 1-99 code group (use 600-699 if you want to spline the lines when plotting). This code group is used for lines; the particular code selected is up to the user. Attributes for a GSMAP entry include **CODE P1** and **P2**. Although P1 and P2 are usually set to 0 for lines, the GSPDC program makes use of the P1 parameter as a place to store the value of the elevation for each contour line.

## Suggestions for editing GSMAP data bases

The GSMAP program or the GSMEDIT program can be used to edit or change parameters for the lines in GSMAP data bases created by the GSPDC program and to add elements needed for final illustrations.

The value of a particular contour line can be determined by identifying the line using the edit mode of GSMAP or GSMEDIT (the P1 value is displayed).

By changing codes and specifications in plot control files, principal contours can be plotted as wide lines, the others as thin lines by using different pens.

By changing codes and specifications in plot control files hatchures can be drawn to identify closed depressions (GSMEDIT can reverse the direction of a line so that the tick marks will point into the depression, check, don't assume that all is well).

An elevation can be added to a reach of a line based on the P1 value for the line. The line can be broken to insert the contour's value, then the broken segment deleted to prevent overplotting. The P1 value of the line can be used to ascertain the value of the contour. Codes in the 700-799 group are suggested so that the number can be appropriately slanted (two-point digitizing).

Contour lines created from grids can be smoothed (splined) when plotted by changing codes to codes in the 600-699 group; this is not true for the two-point line segments generated within the Delaunay triangles.

## Check your results

We urge you to prepare GSMAP plots including contour lines and data points **with Z values plotted** so that you can check all contours and their values against all data points. Check the edges of the contoured area with special care. Figure 27 exhibits one kind of problem, that of grid points too far apart. Check any and all contour maps prepared using a grid against one with the same contour interval prepared without gridding.

The GSPDC program offers two ways of preparing a contour map. Which one is correct? None of the above? Both are honest according to their built in algorithms. Preparation of contours by hand also requires a set of assumptions, perhaps based on more adequate experience, certainly using less predictable and more individual algorithms.

Decisions about contouring are left to the scientific acumen of the user. Please recognize the inherent assumptions. In the area contoured, especially if gridding is employed, the function contoured must be single valued at all points, mathematically continuous, and positively autocorrelated over some length scale at least as large as the typical spacing between observation points (Smith, W. H. F., and Wessel, P. 1990). Act responsibly.

# Output grid, file format

The file printed (in part) below is a portion of a grid file created by GSPDC and illustrates the file format. The grid format is described by Godson and others, 1988, Appendix A (p.18).

|          |          |            |            |            |            |            |            |        |
|----------|----------|------------|------------|------------|------------|------------|------------|--------|
|          | 17       | 17         | 1          | 0.000000   | 0.500000   |            |            |        |
| 0.000000 | 0.500000 |            |            |            |            |            |            |        |
| 0.000000 | 1.0E38   | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38 |
| 0.000000 | 1.0E38   | 937.000000 | 922.000000 | 904.285706 | 880.000000 | 879.500000 | 890.522705 |        |
| 0.000000 | 1.0E38   | 911.754211 | 901.881348 | 895.075928 | 870.857117 | 884.900024 | 903.250000 |        |
| 0.000000 | 1.0E38   | 893.140015 | 879.542053 | 876.278503 | 854.000000 | 868.400024 | 885.307678 |        |
| 0.000000 | 1.0E38   | 879.969666 | 874.439392 | 859.838684 | 839.444458 | 846.835449 | 861.076904 |        |
| 0.000000 | 1.0E38   | 881.742432 | 866.212097 | 846.935486 | 825.555542 | 836.550659 | 848.349060 |        |
| 0.000000 | 1.0E38   | 867.541016 | 855.806458 | 834.584900 | 813.259766 | 814.445129 | 823.702820 |        |
| 0.000000 | 1.0E38   | 851.352478 | 840.174988 | 825.481140 | 802.026001 | 789.703247 | 798.993530 |        |
| 0.000000 | 1.0E38   | 833.514282 | 819.174988 | 811.351868 | 794.591858 | 767.142883 | 770.412842 |        |
| 0.000000 | 1.0E38   | 823.744873 | 811.714294 | 806.861084 | 784.404236 | 765.000000 | 740.000000 |        |
| 0.000000 | 1.0E38   | 835.884766 | 817.366272 | 802.370361 | 778.252625 | 751.200012 | 735.833313 |        |
| 0.000000 | 1.0E38   | 848.024719 | 829.506165 | 800.625000 | 777.673706 | 750.533325 | 726.875000 |        |
| 0.000000 | 1.0E38   | 858.437500 | 824.375000 | 792.030640 | 772.285706 | 750.312500 | 725.344849 |        |
| 0.000000 | 1.0E38   | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     |        |
| 0.000000 | 1.0E38   | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     |        |
| 0.000000 | 1.0E38   | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     |        |
| 0.000000 | 1.0E38   | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     | 1.0E38     |        |

## GSPGRCO

GSPGRCO (GRid and CONtour) has been developed to provide a single program to go from an ASCII file that provides the coordinates of a series of points and a value for a parameter at each point, through review to verify the data, to a gridded data set, to production of a contoured map on screen, to a GSMAP data base, and to a plotted map, using the GSMAP program for editing and plotting. The description here of the creation of the GSMAP data base necessarily assumes familiarity with GSMAP practice.

A review procedure assists identification of anomalous points, be they real anomalies or artifacts produced by problems in the input file.

The gridding algorithm has two parts, listed here in order of priority. If a grid point falls exactly on a data point, the value for that point will be selected. The main sequence of calculations are used to calculate a value for the grid point weights values from data points according to the inverse square of their distance from the grid point. The user specifies a maximum distance from the grid point within which data will be used for computation of the grid point value; points at greater distances will not be used. If there are no data points within the assigned maximum distance of the grid point, no value is assigned for that point.

The grid spacing and maximum distance are selected by the user and entered independently, to allow specification of the best values for the data set being processed.

The spatial coordinates of the data set can be Cartesian (X,Y coordinates) or geodetic (latitude, longitude coordinates). The output gridded data set will be in Cartesian coordinates. If the input data set is in Cartesian coordinates the coordinates of the output grid will use the same Cartesian system. If the input set uses geodetic coordinates, the output coordinates will be provided in Cartesian coordinates, in kilometers, in the projection specified by the user. The contours in the GSMAP data set will be provided in geodetic coordinates if the original data set used geodetic coordinates.

When working with input data sets using geodetic coordinates, output gridded data can be in the following kinds of projected space, in Mercator, Universal Transverse Mercator, Transverse Mercator, Oblique Mercator, Lambert Conformal Conic, Albers Equal Area, Equidistant Conic, or Polyconic map projections. This enables output from X,Y contouring programs to match base maps drawn using any of these map projections.

A geographic portion of an input data set can be selected using a trim polygon with coordinates specified in an ASCII file. By selection of the boundaries of the polygon at to follow discontinuities in the data, separate gridded sets can be created from data points on different side of the discontinuity. For example, if working to create a structure contour map from well data, faults can be used as boundaries for trim polygons, then contours prepared separately for each gridded set to show the effect of the fault without the problems introduced by use of data from both sides of the fault for a single gridded value. One purpose of this release is to facilitate analysis of stratigraphic data using ASCII files prepared from GSLITH data bases. The grid is limited to 10,000 grid intersections. There is a 3,000 point limit on the number of points in the input data set.



## BEFORE STARTING GSPGRCO

You should examine the data to understand the bounds of the area to be gridded and contoured, the values of Z to be expected, and to decide on a contour interval appropriate for a first try. The following files required for operation of GSPGRCO must be prepared before starting the program.

1.

Data file containing geographic (X,Y or geodetic) coordinates and data values for each point. The file format for input data is identical with the GSPOST file in which coordinates are specified in decimal degrees. No header records are permitted. An example is provided below.

|           |    |            |              |        | Data column #1 |
|-----------|----|------------|--------------|--------|----------------|
| "GILL0072 | ", | 44.003340, | -105.268340, | 0,0,0, | 720.00         |
| "GILL0152 | ", | 44.000280, | -105.673620, | 0,0,0, | -948.00        |
| "RENO0001 | ", | 43.562780, | -105.001960, | 0,0,0, | 797.00         |
| "RENO0006 | ", | 43.561670, | -105.199730, | 0,0,0, | -20.00         |
| "RENO0007 | ", | 43.535830, | -105.199730, | 0,0,0, | 14.00          |

2. Projection parameter file.

If geodetic coordinates are used in the input data set a projection parameter file is used if the input data set provides locations of data points using geodetic coordinates to furnish information to the program on the projection to be used for the output (gridded) data set. The content of the projection parameter file is the same as that used by all other programs in System 9.

### 3. Trim polygon file.

If a trim polygon is to be used, a file containing coordinates of points making up the trim polygon must be prepared. (the trim polygon may contain as many as 1,000 points. Use as many as needed, but be aware that use of a complex polygon defined by many points will slow the gridding process.

One convenient way of creating such a file is described here. GSMAP Version 9.0 was used to digitize a five point polygon.

Option 2 of GSMUTIL was then used to create an ASCII file from the binary GSMAP data base. This file is printed below, the part to be saved is underlined:

GEODETTIC

TRIMFILE

|                  |                    |
|------------------|--------------------|
| 38.250000        | -105.375000        |
| 38.125000        | -105.375000        |
| 38.125000        | -105.250000        |
| 38.250000        | -105.250000        |
| 1                | 5                  |
| 1                | 0                  |
| 0                | 0                  |
| <u>38.176908</u> | <u>-105.319072</u> |
| <u>38.185885</u> | <u>-105.294207</u> |
| <u>38.160160</u> | <u>-105.259277</u> |
| <u>38.140349</u> | <u>-105.280655</u> |
| <u>38.176908</u> | <u>-105.319072</u> |

The two header records, the GSMAP data base corners, the line providing entry number, number of points, code, P1, P2, and a non-printing line at the end of the file were then removed to provide the finished trim file printed below.

|           |             |
|-----------|-------------|
| 38.176908 | -105.319072 |
| 38.185885 | -105.294207 |
| 38.160160 | -105.259277 |
| 38.140349 | -105.280655 |
| 38.176908 | -105.319072 |

Alternatively, especially if the trim polygon has a simple outline, the file can be prepared using a text editing program. The polygon must be closed (the coordinates of the first and last point must be identical).

## OPERATION OF GSPGRCO

The program GSPGRCO supplies a series of prompts; each must be answered in turn by typing the answer on the keyboard, then hitting the Enter key to enter the response into the program. Start by entering GSPGRCO. After display of a brief disclaimer message, the sequence of prompts will begin:  
ARE YOU WORKING WITH GEODETIC COORDINATES? (Y/n/QUIT TO EXIT):

Answer Y if the data file provides geodetic coordinates. The default is N (for Cartesian coordinates).  
If N the next prompt will be skipped. If Y the next prompt will be:  
ENTER FILENAME OF PROJECTION PARAMETERS: ?

Enter the name (with extension) of the projection parameter file. The next prompt will be:  
DO YOU WANT TO TRIM ON A POLYGON BOUNDARY? (Y/N):

Answer Y if you wish to use a trim polygon. The default answer is N. If N the next prompt will be skipped. If Y the next prompt will be:  
ENTER NAME OF POLYGON TRIM FILE:

Enter the full name (with extension) of the file containing the trim polygon. The next prompt will be:  
ENTER THE NUMBER OF DATA COLUMNS:

Enter the number of data columns (the number of columns to the right of the 0,0,0 columns (this follows GSPOST practice) e.g. 1. The next prompt will be:  
ENTER THE COLUMN to be gridded.

Enter the number of the data column to be gridded e.g. 1. After this entry there will be a pause to allow the program to read and sort the data contained in the data file. After this pause a data screen will be displayed that contains contents similar to the print below.

| ORIGINAL DATA VALUES |           |            |          |
|----------------------|-----------|------------|----------|
| NO OF POINTS= 168    |           |            |          |
| X MINIMUM=           | -80.382   | X MAXIMUM= | -0.158   |
| Y MINIMUM=           | 4819.513  | Y MAXIMUM= | 4873.525 |
| Z MINIMUM=           | -2502.000 | Z MAXIMUM= | 1428.000 |

| CURRENT GRID VALUES |          |              |          |
|---------------------|----------|--------------|----------|
| X MINIMUM           | -80.382  | X MAXIMUM=   | -0.158   |
| Y MINIMUM=          | 4819.513 | DY=          | 4.011    |
|                     |          | Y MAXIMUM=   | 4873.525 |
| RADIUS=             | 5.000    | NO. OF ROWS= | 10       |
|                     |          | NO.OF COLS=  | 10       |

ENTER XMINIMUM FOR GRID: ?

A series of prompts now requires specification of the parameters for the grid and the contours. When working with geodetic coordinates the grid interval and the values for the two radii are entered in kilometers.  
Respond to each prompt in turn:

ENTER X MINIMUM FOR GRID: ?

Enter the minimum value for the X coordinate of the grid, e.g. -80.

**ENTER X MAXIMUM FOR GRID: ?**

Enter the maximum value for the X coordinate of the grid, e.g. 0.

**ENTER Y MINIMUM FOR GRID: ?**

Enter the minimum value for the Y coordinate of the grid, e.g. 4800.

**ENTER Y MAXIMUM FOR GRID: ?**

Enter the maximum value for the Y coordinate of the grid, e.g. 4900.

**ENTER Z MINIMUM FOR GRID: ?**

Enter the minimum value for the Z coordinate of the grid, e.g. -2600.

**ENTER Z MINIMUM FOR GRID: ?**

Enter the minimum value for Z, e.g. -80.

**ENTER Z MAXIMUM FOR GRID: ?**

Enter the maximum value for Z, e.g. 1450.

**ENTER GRID INTERVAL**

Enter the spacing for the grid; if Cartesian coordinates are in use, use the coordinate system of the data; if geodetic, enter the grid spacing in kilometers e.g. 5. If the number of rows multiplied by the number of columns is less than four or greater than 10,000 an error message will be shown, and operation returned for examination of the input data. Parameters can be changed at this stage. The default answer to each prompt is the value displayed on the screen. If the grid response is appropriate the sequence of prompts will continue.

**ENTER RADIUS OF INFLUENCE: ?**

Enter the value desired for the radius of influence (see discussion in the introduction), e.g. 10

**ARE THE PARAMETERS OK?(Y/N): ?**

The values entered are now displayed on the screen; the prompt calls for a check, and entry of Y if all is well. If not, answer N and opportunity will be provided for change. The next prompts are related to the contours desired.

**ENTER MINIMUM CONTOUR VALUE: ?**

Enter the value of the minimum contour, e.g. -2600.

**ENTER MAXIMUM CONTOUR VALUE: ?**

Enter the value of the maximum contour, e.g. 1500.

**ENTER DELTA CONTOUR VALUE: ?**

Enter the value of the contour interval, e.g. 250.

After this entry a third box will be added to the screen display to indicate the values in effect for the contours.

CURRENT CONTOUR VALUES

MIN.CONTOUR=-2575.000 INTERVAL= 250.000 MAX.CONTOUR=1500.000

ARE THE PARAMETERS OK? (Y/N) : ?

Answer Y or N. If yes, the screen will display the grid, circles around each data point, and the contours requested. On a color EGA or VGA monitor the grid will be shown in gray, the circles in brown, the contours in bright yellow. the prompt will ask if you wish to change the contour values.

RESET CONTOUR VALUES?(Y/N): ?

Answer Y or N. If Y (yes), opportunity will be afforded to reset contour parameters. If N

RESET GRID PARAMETERS? (Y/N): ?

Answer Y or N. If Y (yes), opportunity will be afforded to reset grid values. If N a prompt will ask if review is desired:

REVIEW?(Y/N): ?

"REVIEW" is a means of identifying data points used for calculation of grid values using an on-screen cursor as a pointer to select grid points. If you wish to check data points used to calculate for one or more grid points, enter Y. The prompt on the lowest line of the screen will be:

A = IDENTIFY B = WINDOW C = REFRESH D = ID CON LINE E = EXIT ENTER FUNCTION:?

The options A = IDENTIFY, B = WINDOW, and C = ID CON LINE require moving a cursor (+) on the screen to a user-chosen position. The cursor can be moved either in Fast mode or Slow mode.

In fast mode the cursor moves in 20 pixel increments, in slow mode, one pixel at a time. Use the slow mode for precise positioning.

Cursor movement:

The cursor is moved on the screen using the arrow keys on the numeric keypad for lateral and vertical movements, and the Home, End, PgUp and PgDn keys for diagonal movements (the Num lock must be OFF:

→ right  
← left  
↑ up  
↓ down  
Home=up and left  
End=down and left  
PgUp=up and right  
PgDn=down and right

## Review functions

### A=IDENTIFY

Move cursor (+) to a grid intersection, hit the Enter key

The line at base of screen will display the identifier, X and Y coordinates, and Z value for a data point used in calculation of this grid value.

REN00054 65.649 4824.033 -2136.000

Hit any key to move to another data point influencing the value of the grid intersection. Continue to identify all of the points used in calculation of this value. After all have been identified hitting any key will return to the prompt:

A=IDENTIFY B=WINDOW C=REFRESH D=ID CON LINE E=EXIT ENTER FUNCTION:?

### B=WINDOW

Window to enlarge a part of the screen display. This is done by identifying the lower left and upper right corners of the area to be windowed.

#### ENTER LOWER LEFT CORNER

Move cursor (+) to lower left corner of desired window, hit the Enter key.

#### ENTER UPPER RIGHT CORNER

Move cursor (+) to upper right corner of desired window, hit the Enter key.

### C=RESTORE

Restores the original view after windowing.

### D=ID.CONT

Move the cursor to a position on one of the contour lines, then hit the enter key to identify the line. The value of the contour line will be displayed on the bottom line of the screen.

### E=ID.GRD

Move the cursor to a grid point. Hit the Enter key to identify the grid value.

### F=SPL.OFF

F acts as a toggle to spline (or not spline) contour lines on the screen.

### G=CH.PDIST

G affords opportunity to change the pointing distance used to identify data and grid points.

### H=EXIT

The exit function returns to permit resetting parameters chosen for the grid or for the contours.

RESET GRID PARAMETERS?(Y/N): ?

If you answer N the program will prompt:

WRITE GRID VALUES TO ASCII FILE?(Y/N): ?

The format of the file is the same as that produced by GSPDC, and printed on p. \*\*228

WRITE CONTOUR VALUES TO GSMAP DATA BASE(Y/N): ?

If you wish to create a GSMAP data base containing the contour lines, answer Y. The program will then prompt:

ENTER OUTPUT DATA BASE NAME:

Enter the name desired for the GSMAP data base. The next prompt will ask for entry of the title for the data base:

ENTER OUTPUT TITLE(16 MAX):

Enter the desired title, 16 characters or less.

The program then prompts entry of the coordinates of the corners of the GSMAP data base.

#### Cartesian coordinates

The following prompt starts the procedure for specifying corners for a new data base using Cartesian coordinates:

OPTIONAL METHODS FOR SPECIFYING DATA BASE CORNERS

- 1 - SPECIFY UPPER RIGHT CORNER (X,Y)
- 2 - SPECIFY LOWER LEFT (X,Y), UPPER RIGHT(X,Y)
- 3 - ALL FOUR CORNERS

ENTER OPTION:

If option 1 is chosen the coordinates of the lower left corner will be set to 0,0. Values for the coordinates of the two unspecified corners will be set to define a rectangle based on 0,0 and on the X,Y coordinates of the upper right corner point; option2 also defines rectangular coordinates for the data base. Option 3 permits independent entry of the coordinates for each of the four corner points (not necessarily a rectangle).

#### Geodetic coordinates

Geodetic corner coordinates are entered in the following format

:DD,MM,SS,C,DDD,MM,SS,C: Latitude in degrees, minutes, seconds, Compass direction (N or S), Longitude in degrees, minutes, seconds, Compass direction (W or E), with commas separating the entries, for example 38,30,0,N,106,15,0,W. For Compass direction use N for north latitude, S for south latitude, W for west longitude, E for east longitude. The prompt below specifies the procedure for specifying corners for a new data base using Geodetic coordinates:

TYPES OF MAPS

- 1 - 7 1/12 MINUTE
- 2 - 15 MINUTE
- 3 - 30 MIN LAT x 2 DEG LONG
- 4 - 1 DEG LAT x 2 DEG LONG
- 5 - OTHER

ENTER TYPE:

Enter the number corresponding to the data base desired. If type 1, 2, 3 or 4 is selected the following

prompt will be seen:

ENTER LAT/LON OF NORTHWEST CORNER:

DD,MM,SS,C,DDD,MM,SS,C:

Entry of the required coordinates for the northwest corner of the map will return the screen to the Main Menu; coordinates for the other three corners of the data base will be computed by the program.

If type 5 is selected the following prompts will be seen, requesting entry of the latitude/longitude coordinates of the four corners of the map:

ENTER LAT/LON OF NORTHWEST CORNER

DD,MM,SS,C,DDD,MM,SS,C:

ENTER LAT/LON OF SOUTHWEST CORNER

DD,MM,SS,C,DDD,MM,SS,C:

ENTER LAT/LON OF SOUTHEAST CORNER

DD,MM,SS,C,DDD,MM,SS,C:

ENTER LAT/LON OF NORTHEAST CORNER

DD,MM,SS,C,DDD,MM,SS,C:

Completion of entry of the four coordinates in required form brings operations to the next prompt:

The prompts for geodetic corners are as below:

ENTER LAT/LON OF NORTHWEST CORNER

DD,MM,SS,C,DDD,MM,SS,C

ENTER LAT/LON OF SOUTHWEST CORNER

DD,MM,SS,C,DDD,MM,SS,C

ENTER LAT/LON OF SOUTHEAST CORNER

DD,MM,SS,C,DDD,MM,SS,C

ENTER LAT/LON OF NORTHEAST CORNER

DD,MM,SS,C,DDD,MM,SS,C

Answers to these prompts follow GSMAP practice, e.g. 38,0,0,N,105,0,0,W

ENTER GSMAP CODE FOR CONTOUR LINES (1-99):

Enter the code desired, e.g. 10. The program writes data for the contour lines to the GSMAP data base. The code for the lines is as specified by the user. P1 for each line is the numeric value of the contour. P2 is set to 0 for all lines.

After the data has been written to the GSMAP data base, the prompt will be:



# WRITE CONTOUR LINES TO AN ASCII FILE: ?

If Y the program will prompt for entry of the name of the output file. After input of a file name or if you answer N the program will move to the next prompt:

The format for the ASCII file is shown below:

|            |             |                                        |
|------------|-------------|----------------------------------------|
| -2400.000  | 7           | [CONTOUR VALUE, NUMBER OF DATA POINTS] |
| -85.000000 | 4843.116211 | [X,Y IN KILOMETERS ]                   |
| -80.793961 | 4845.000000 |                                        |
| -80.000000 | 4845.270020 |                                        |
| -79.851357 | 4845.000000 |                                        |
| -79.852913 | 4840.000000 |                                        |
| -77.913406 | 4835.000000 |                                        |
| -80.000000 | 4831.616211 |                                        |

PROCESS ANOTHER SET OF DATA (Y/N)

Enter N to return to the DOS prompt; respond Y to the prompt if you wish to go on with gridding and contouring operations.

## SUGGESTIONS ON EDITING GSMAP DATA BASES CREATED BY GSPDC OR GSPGRCO

We suggest that the steps outlined below provide a direct method for editing the data base containing contour lines produced by the GSPGRCO program and labeling the contour lines to produce a finished graphic product. The description assumes knowledge and availability of GSMAP Version 9.0 and other programs released with it.

1. Create a plot control file for the finished illustration using a text editing program. Include the code selected for contours when using GSPGRCO. Add a code for the contours you wish to draw with a heavy line. If you wish, select codes in the 600-699 group to obtain smoothing by splining when plotting. Include a code of the 700-799 group to be used when labeling contours; this group is used because by digitizing two point entries the proper slant for each label can be introduced when digitizing. Print a copy of the plot control file.
2. Create a text file (database.RU) that contains the values for the contours to be labeled. This is easily done using option 6 of the GSMUTIL program. Print a copy of this "label" file.
3. Make back-up copies of all files.
4. If you wish to spline the contour lines use GSMAP option 6 to change the values for contours to the codes in the 600-699 group selected. Print a list of the contents of the data base, GSMAP option 7. The P1 value for each (parameter 1) is the contour's value. Codes for principal (heavy-line contours can be changed at this point, or later).
5. Use GSMAP to plot a hard copy of the contour lines. Examine this plot and the base map to locate places where labels would interfere with features on the base map, and hence should not be placed. A draft mode plot with all lines drawn with a fine pen is useful; it will provide the entry numbers for each line segments.
6. Use the GSMEDIT program. Window to select a suitable portion of the area for digitizing. Select a contour line, identify it, check its P1 value against the values in the text file. Switch to the **Digitize** mode, you are working from a documented copy, aren't you ? Digitize the proper label using the 700-799 code selected using two points to set the slope for the label. Check to see if properly placed. Return to the Edit mode, adjust the slope and position of the label as needed. When suitable, identify the contour line that by now goes through the label. Break this line at suitable points on each side of the label. Delete the segment of the contour line that runs through the label. Done. Proceed to the next line that needs to be labeled. The edit function in Option 3 of GSMAP could be used, but you would have to make another plot to find out where to break the contour lines after inserting the labels. This can be seen on the screen using GSMEDIT.
7. Complete the data base, adding graphical elements as desired. For example, the contours might be added to a digital data base that contains county outlines, or a geologic map. Plot the map using GSMAP, edit as needed, using Option 3, or use GSMEDIT to make final adjustments.

## CHAPTER 8

### QUEIT

#### PLOTS FROM HPGL FILES

GSMAP Version 9.0 and other programs at "levels 5-9" in the GS series can create ASCII files written in HPGL (Hewlett Packard Graphics Language) as one output option. The QUEIT program makes use of these HPGL files to drive a plotter (that supports HPGL).

The program file QUEIT.EXE and the configuration file CONFIG9.PLT must be in the default drive or installed using an environmental variable.

#### Operation of QUEIT

The program is started by entering QUEIT. Reply to each prompt in turn:

ENTER NAME OF QUEUED PLOT FILE (QUIT TO EXIT):

If you wish to proceed, enter the name (with extension) of the file to be plotted, an on-screen message will remind you that the plotter must be on and paper loaded. If there is a problem with the configuration file or if the plotter isn't ready, the system will come to a complete stop and may have to be rebooted.

After entry of the name of the QUEUED PLOT file (the HPGL file), QUEIT will drive the plotter to make the plot. After completion of the plot the system will return to the DOS prompt.

Version 9 of QUEIT has been revised to optimize pen selection in an attempt to reduce plotting time for large illustrations.

## CHAPTER 9

### GSLITH Version 9

GSLITH is a program designed to organize, store, and process data that define the "vertical" sequence of rock units and in this version supports latitude, longitude or Cartesian coordinates. The program's name comes from Geological Survey Lithology. The program requires an IBM PC-compatible microcomputer and a digitizer and a plotter for full implementation. The format of the GSLITH data files for Version 9 has been changed from that of System 8. This change has been made so that Cartesian coordinates could be supported (geodetic only in Version 8). Data bases used by GSLITH System 8 and GSLXY Version 1 can be converted to GSLITH Version 9 using Options 12 or 13 of the GSLUTIL program.

Graphic and numeric output from GSLITH data bases assist analysis of lithologic and associated numeric data from drill holes. The words "hole" or "well" are used in this documentation to indicate a place where data on the vertical sequence of units are available, with obvious extensions to an outcrop. Lithologies and graphical numeric data are shown on plots by lines and patterns chosen by the user and drawn on cross section and plan views.

The program can draw a series of cross sections from drill hole data plotting the lithologic units in the drill hole, and numeric variables (such as chemical values) at true positions as projected to the vertical plane of section. This provides a quick and accurate way of determining the consistency of a data set, locating critical holes, identifying errors in the data, and starting the process of data analysis. These sections also furnish a basis for construction of standard cross sections, allowing the geologist to connect like features without the tedium of projecting well data to the plane of section.

Plots of drill holes on cross sections can be made at true elevations, or adjusted so that the base or top of a specified unit, or a particular contact is plotted at a specified elevation. Such alignment of a stratigraphic horizon may facilitate stratigraphic analysis. If a contact is specified, only those holes where this contact has been identified in the data will be plotted. A type of block diagram can be constructed on a single sheet by drawing a series of stacked cross sections, thus providing an overview of a data sets in three dimensions. The program projects data from slant holes to the plane of cross section in proper geometric projection, including changes in apparent thickness of units and apparent plunge of slant holes to accommodate the bearing and plunge of the hole and horizontal and vertical scale selected for the section.

Plan views can be drawn to provide information on the stratigraphic and structural framework of an area. A plot of the elevation of the contact of two units provides data for construction of a structure contour map. A plot of the thickness of a unit provides data for construction of an isopach map. ASCII files generated by GSLITH can be used with computer-driven contouring programs. If the elevation data from a series of holes are adjusted to bring a particular contact to a specified vertical position by the program, a plot of the vertical offset required for this adjustment provides insight into the shape of this contact in three dimensions. Horizontal slices through well data sets provide data for a subsurface geologic map at the chosen elevation. Figure 5 is a plan view of a hypothetical set of drill holes. Examples of plots from GSLITH are provided in figures 36-40, p. 291-295.

GSLITH can be used to digitize the locations of drill holes, measured sections, or other places where information has been obtained. It stores information about the vertical extent of units at each locality, and as many as five numeric variables that apply to each unit. It employs a user-defined "standard set" of unit identifiers. Input of data for units at each locality is checked against this standard set to guarantee consistency. Plotter patterns are specified by the user for each unit, and are used in drawing plan views and cross sections. As many as five numeric variables associated with each unit can be stored in the data base and plotted on sections.

Upper and lower vertical limits can be specified for sections, and data within these limits plotted. This allows use of a greater range of vertical scales without exceeding plotter limits. The map projections supported for digitizing and plotting include standard Version 9 set.

As with other programs of System 9, GSLITH can drive a plotter, or generate HPGL (Hewlett Packard Graphics Language) files for later use with plotters or printers with appropriate software.

All graphics to be previewed on the screen.

Plan view plots can be registered to corner ticks on plotter sheets (or topographic maps) at the time of plotting.

The special section view will fill in the section between wells for each bed that is completely contained in both adjacent wells.

The utility program GSLUTIL assists in working with data bases, including the reformatting of Version 8 GSLITH data bases to Version 9 and GSLXY Version 1 data bases to Version 9. Its options enable export and import of ASCII files from and to GSLITH data bases, change of identifiers for specific beds throughout a data base, geographic trimming to select parts of a data base, and perform other tasks related to management and editing of data bases.

The edit program GSLEDIT is designed to facilitate editing of GSLITH data bases by enabling easy selection of wells in a data base from plan views, viewing sections showing the wells on the screen, then enabling editing of elements of the data. GSLEDIT can alternate quickly between plan views, sections, and screens enabling editing of the data base.

The user must create projection parameter files, unit identifier files (standard extension ,BED), and plot control files (.PLT) for each project. Instructions are provided in this documentation.

GSLITH requires the standard Version 9 configuration files, CONFIG9.SCR, CONFIG9.PLT, CONFIG9.DIG, and CONFIG9.SYM. If these have been installed for GSMAP Version 9, no modification is required.

## GSLITH Options - Sections

The GSLITH program provides options to adjust the vertical positions of plots of drill hole data on cross sections. An understanding of some of the algorithms used by the program is important to understanding these procedures. In this description, the base or top of a unit refers to the bottom or top of a unit as recorded in the well log. They are not necessarily the stratigraphic base or top. The contact of two units refers to a position in a well where the elevation of the base of the upper unit is identical to the elevation of the top of the lower unit. Once again, this position is not necessarily a stratigraphic contact. The base and top depend on a single record in the log, a contact depends on two.

Cross sections drawn by the GSLITH program show the units encountered in the well using the plotter patterns specified by the user in the file containing the "standard set" of unit identifiers. Drill holes are shown at the angle of "apparent plunge", the angle of plunge is projected to the vertical plane of the cross section.

Cross sections can be plotted at true elevation, can be adjusted vertically to bring a contact between two units to a specified elevation, or can be adjusted to align the plots at a specified elevation for the base of a designated unit. If the unit is present more than once in the well, vertical adjustments will be made according to the base of the uppermost unit.

Vertical lines are drawn at both ends of the cross-section, tick marks are drawn on these end lines at user specified intervals, to make a vertical scale, and numerical elevations are posted at these tick marks near the end lines.

A "Legend", a series of rectangles filled with the patterns for each unit in the standard set followed by the identifier for the unit, can be drawn on the cross section at a specified location. If there are units in the well not included in the standard set of identifiers, nothing will be plotted to represent this unit.

Four different methods of creating cross sections are supported:

Type 1. The beginning and ending points of a line of cross section are specified by the Latitude and Longitude coordinates of the end points of the desired section on the plan view. Wells within a specified distance of this line are selected, by specifying this distance in feet. Wells within this distance (both sides of the line of section) are projected to the line of cross section (perpendicular to this line) and drawn in section. An ASCII file can be created during this procedure and used to generate a section of Type 3.

Type 2. The beginning and ending points of a line of cross-section are defined by their latitude, longitude coordinates; wells designated by identifier are projected to this line of section and drawn in cross section. An ASCII file can be created during this procedure and used to generate a section of Type 3.

Type 3. All parameters of the cross section are specified in an ASCII file: these include the beginning and ending points of the line of section (measured in inches to the top of the well along the section), and listings of well numbers, and their desired position along the line of section. All wells are plotted as if vertical.

Type 4. All parameters of the cross section are specified in an ASCII file: these include the beginning and ending points of the line of section (measured in inches to the top of the well along the section), and listings of well numbers, and their desired position along the line of section. All wells are plotted as if vertical. A type 4 section is used to draw special sections on which the units are connected between wells with lines or patterns.

The first two types of cross sections enable plotting and analysis of well data. The first plots all wells in a band specified by width along the line of section. The second allows selection of individual wells, and hence omission of unwanted or overlapping wells on the plot. The third facilitates the checking of data and data entry. The fourth is like the third except that as used with Option 10 from the Main Menu, units can be connected either with filled areas or with lines at like top and bottom contacts.

## GSLITH Options - Plan Views

The area drawn on plan views is specified by providing the latitude and longitude coordinates for the corners. Eleven different types of plots can be drawn. For ten of these numerical data from the well log is posted immediately to the right of a symbol (of users choice) plotted at the well location. The posted data may be any of the following:

- Well identifier
- Elevation at the top of the well
- Elevation at the bottom of the well
- Depth of the well
- Elevation at the top of a unit
- Elevation at the bottom of a unit
- Thickness of a unit
- Elevation of a contact between two units
- Thickness of a unit between two contacts
- Computed vertical offset necessary for alignment of a horizon to a specified elevation.

If a unit is present more than once in a well, the specified values will be posted in sequence, that for the upper above that for the lower.

Another kind of plan view shows the unit present at a designated elevation, as if cut by a horizontal slice through the ground. The units are shown by patterns specified by the user in the standard set in a square box of size specified at the time of plotting. If a contact between two units has been adjusted to a specified elevation, the slice is cut and well intersections drawn as adjusted to the specified contact, not at a "true" elevation of intersection.

ASCII files can be generated after drawing plan views that provide locations and the numerical values of the variable chosen.

GSLITH operates from a Main Menu screen. An option is selected by entering the number of the option desired. Type the number, then hit the ENTER key. After selecting an option, a series of prompts will be displayed. Each must be answered in turn. Type the response, then hit the ENTER key.

A data base is specified by entering its name, observing DOS conventions for naming files. The extensions for the two files generated by the program for each data base are not entered. Drives, or directories other than the active area can be specified by following DOS conventions.

A file is specified by entering its full name with extension. Drives, or directories other than the default can be specified by following DOS conventions.

Latitude and longitude coordinates are entered in degree, minute, second, compass direction format. Prompts will show this by DD,MM,SS,C,DDD,MM,SS,C. Provide commas in all of the places specified. An example of the response might be: 38,15,0,N,106,30,0,W. Remember that latitudes are N and longitudes W in the conterminous 48 states.

For most entries upper or lower case letters are equivalent: either may be used. This is **NOT** the case for well identifiers and lithologic (unit) identifiers. For these case sensitive names, upper and lower case letters are different.

Unit identifier files, projection parameter files, and plot control files must be prepared before starting a GSLITH session. The sections beginning on p. 244 and on p. 263 describe these files.

## OPERATION OF GSLITH

The GSLITH program is menu driven. The user operates the program by making choices from menus or by responding to messages and prompts (requests for entries) displayed on the screen. A unit identifier file must be prepared before creating or opening a data base. Before using options for digitizing and plotting, projection parameter files must be prepared. Plot control files must be prepared before plotting, as well as the control files that are used for plots of numeric variables on sections.

Start operation of the program by entering **GSLITH** at the DOS prompt. First the disclaimer screen will be briefly displayed briefly, then operation will begin using the Main Menu.

If you know the name of the existing data base you want to use, type **GSLITH** , then a blank, then the name of the data base, then hit the **ENTER** key, and the menu screen will be bypassed, and operations will go immediately to entry of the name of the bed file.

|                           |                               |
|---------------------------|-------------------------------|
|                           | DATA BASE:<br>BED FILE:       |
| 1 -                       | START A NEW DATA BASE         |
| 2 -                       | OPEN AN EXISTING DATA BASE    |
| 3 -                       | DIGITIZE NEW WELL LOCATIONS   |
| 4 -                       | DELETE A WELL                 |
| 5 -                       | RECOVER A WELL                |
| 6 -                       | ENTER UNIT RECORDS FOR A WELL |
| 7 -                       | EDIT UNIT RECORDS FOR A WELL  |
| 8 -                       | LIST CONTENTS OF DATA BASE    |
| 9 -                       | PLOT STANDARD SECTION VIEW    |
| 10 -                      | PLOT SPECIAL SECTION VIEW     |
| 11 -                      | PLOT PLAN VIEW (POSTING)      |
| 12 -                      | ISSUE DOS COMMAND             |
| 13 -                      | EXIT                          |
| ENTER CHOICE BY NUMBER: ? |                               |

To operate GSLITH, either a new data base must be started using Option 1 or an existing data base must be opened using Option 2. Choice of another option before selecting a data base will bring the reminder:

You must start or open a DATA BASE before using options 3-11  
Press any key to continue.



## OPTION 1. START A NEW DATA BASE

Enter 1 from the menu screen. The screen will clear and prompts will request entry of the **NAME** for the new data base. This name will be used as the filenames for the two files that make up the data base, the index file and the data file. The data base name can consist of up to eight alphanumeric characters containing no blanks, periods or commas. The extension NDX will be added for the index file; LSF will be added for the data file. DOS conventions for naming files must be followed when specifying data base names.

A prompt will then request entry of a **TITLE**. A name with up to 36 characters can be used. This title will be shown on data listings. The next prompt will ask if the data base is to use geodetic or Cartesian coordinates:

Another prompt will provide information to help open the data base:  
The prompts below apply to geodetic data bases. Slightly different prompts will be displayed if Cartesian coordinates are to be used.

### TYPES OF MAPS

- 1 - 7 1/2 MINUTE
- 2 - 15 MINUTE
- 3 - 30 MIN LAT x 1 DEG LONG
- 4 - 1 DEG LAT x 2 DEG LONG
- 5 - OTHER

Enter the type desired: e.g. 2

If a map type 1-4 is chosen, the next prompt will request entry of the latitude and longitude coordinates for the northwest corner of the map area. If type 5 is chosen, coordinates for all four corners must be entered. These coordinates for the map corners can be used as default corners when digitizing. These coordinates must be entered in the format shown on screen (degrees, minutes, seconds, compass direction, separated by commas. This is shown by prompts with the format DD,MM,S,C,DDD,MM,S,C. Remember that latitudes are N and longitudes W in the conterminous 48 states.

Another prompt will ask for the number of numeric variables. Enter the number desired. 0 to 5 can be specified.

After these entries, prompts will call for entry of the name of the file (including extension) containing the valid bed identifiers. After this is supplied, operation will return to the main menu.

Starting a new data base using option 1 establishes it as the current data base for the session in GSLITH unless this is changed using Options 1 or 2. It also establishes the specified unit identifier file as the operative identifier file. The number of numeric variables is fixed for a given data base. If more numeric variables (limited to 5 total) are needed, a new data base should be created and the old data added to the new data base using the merge option (option 5) of the utility program GSLUTIL.

## OPTION 2. OPEN AN EXISTING DATA BASE

the user will generally work with a data base started in a previous session, one for which the database files already exist. Selection of Option 2 (enter 2 from the main menu will clear the screen and bring a prompt requesting the name of the data base.

ENTER MAP DATA BASE NAME: ?

The name of the desired data base should be entered. The program will add the extensions NDX and LSF to the data base name, check to see that both of the required files exist, and will open the data base if they do. If the files cannot be found in the default area a prompt will again call for entry of the name of a map data base. Pressing the ENTER key at this prompt will return operations to the Main Menu.

After entry of the name of a valid data base a prompt will request entry of the name of the file (including extension) containing the valid bed identifiers.

Enter filename for Valid Bed Identifiers: ?

After this entry operation of the program will return to the Main Menu screen. The name of the current DATA BASE and the BED FILE will be shown on the upper right part of the screen.

Glorious entrance. When starting GSLITH or GSLEDIT if you type the name of the program, a blank space, then the name of an existing data base, the program will begin and open this data base.

### OPTION 3. DIGITIZE NEW WELL LOCATIONS

Make sure that the map to be digitized is securely fixed to the digitizer table within the active area of the digitizer. The map must not move during digitizing. Selection of Option 3 from the Main Menu screen will clear the screen and bring a prompt for entry of the projection file to be used.

ENTER FILENAME OF PROJECTION PARAMETERS: ?

Enter the name of the projection file. The next prompt will be:

ARE THE DATA BASE CORNERS THE CORNERS OF THIS MAP?(Y/N):

Enter Y if the corners are the same. If the corners to be used for registering the map to the digitizer table are not the same as the data base corners respond N to this prompt. The default (hit enter key is N). If you enter N prompts similar to those used to start a data base will be shown:

#### TYPES OF MAPS

1 - 7 1/2 MINUTE

2 - 15 MINUTE

3 - 30 MIN LAT x 1 DEG LONG

4 - 1 DEG LAT x 2 DEG LONG

5 - OTHER

Enter the type desired, as in Option 1:

The next prompts establish a "mask" to enable use of alpha characters at the start and end of the well identifier. The prompts are as below.

FOLLOWING QUESTIONS APPLY TO WELL ID MASK(MAX OF 12 CHARS (TOTAL)

ENTER PREFIX: ?

MAXIMUM NUMBER OF DIGITS: ?

ENTER SUFFIX: ?

If no prefix or suffix is desired, respond to the prompt by hitting the ENTER key. After responding to these three prompts, digitizing will require entries from the keypad of the digitizer.

ENTER 0 (ZERO) KEY ON CURSOR KEYPAD TO SYNCHRONIZE DIGITIZER INPUT

For this entry from the digitizer the position of the cursor within the active area of the digitizer is not important: press the zero key on the keypad of the digitizer.

The next part of the digitizing procedure indexes the map to the digitizer table using the map corners. Follow the directions provided by the screen prompts as they appear:

ENTER NORTHWEST CORNER ON DIGITIZER

ENTER SOUTHWEST CORNER ON DIGITIZER

ENTER SOUTHEAST CORNER ON DIGITIZER

ENTER NORTHEAST CORNER ON DIGITIZER

These entries are made by pressing the zero key on the cursor keypad with the cross hair of the cursor precisely positioned on the map at the position called for. These entries complete the indexing of the map to the digitizer table. A prompt will appear:

X SCALE=        YSCALE=

CONTINUE (Y/N) ?

If there is a problem in indexing the corners, you may get a message:  
SCALE DIFFERS BY MORE THAN 2%, CONTINUE (Y/N?).

This message almost always indicates a problem. Digitizing should not continue (answer N).

If all is well enter Y from the keyboard so that digitizing can continue. A prompt will then appear:  
ENTER WELL IDENT:

Choose a well to start digitizing. Then using the keypad of the cursor, enter the number of the well (the number between the prefix and suffix specified). After entry the complete identifier will be shown on the screen followed by a prompt:  
ENTER LOCATION ON DIGITIZER:

Accurately position the cross hair of the cursor at the location of the well being digitized , and depress the 1 key to record this location. After this has been done, the system is ready to accept the number for another well from the keypad. The prompt ENTER WELL IDENT: will again be shown.

Continue the procedure to enter the next well number, then digitize the location of the new well. Continue until all desired wells have been entered and their locations digitized.

To change any part or all of the identifier mask (prefix, number of digits, or suffix) press the C key on the keypad of the digitizer at the point where a new well number is to be entered. This will return to the prompt sequence requesting entry of prefix, number of digits, and suffix, and thence lead back to digitizing.

If an incorrect well identifier is entered, pressing the E key before digitizing the location of the well will return the system to the ENTER WELL IDENT: prompt so that an incorrect entry can be avoided.

### Digitizing

If you attempt to enter a well identifier that has already been entered, the program will ask if you wish to redigitize the location for this well before allowing its position to be re-digitized. A "Y" from the keyboard of the computer will allow you to re-digitize this position. A "N" from the keyboard will return the digitizing procedure to permit entry of a new well identifier. The newly digitized location will replace the old in the data base.

For well identifiers either upper case letters or lower case letters may be used; they are NOT equivalent: Eg. T21 and t21 are not the same. Alphanumeric prefixes and suffixes are specified when defining the mask.

Prefix, maximum number of numeric digits , and suffix can be changed during the digitizing session by hitting the C key instead of entering a number for a well. This will bring prompts allowing resetting of prefix, maximum number of variables, and suffix.

End the digitizing session by pressing the C key on the keypad instead of entering a well number. The prompts requesting entry of prefix, number of digits, and suffix will be provided. Press the ENTER key on the keyboard of the computer instead of supplying a prefix, number of digits, and suffix at each of these prompts. This returns operations to the Main Menu screen.

## DIGITIZING USING A ONE-KEY CURSOR: THE MENU TEMPLATE

### Use of the Menu Template

GSLITH Option 3, DIGITIZE, like GSMAP and GSDIG supports a one key digitizer by using a "MENU TEMPLATE", see below.

Select Option 3 (DIGITIZE NEW WELL LOCATIONS) from the Main Menu: enter 3 from the keyboard. Prompts will tell you what to do at each step. When digitizer entries are requested move the cursor to the points requested and press a key, as prompted:

ENTER LOWER LEFT CORNER OF MENU ON DIGITIZER

ENTER TOP RIGHT CORNER OF MENU ON DIGITIZER

ENTER UPPER LEFT CORNER OF DRAWING ON DIGITIZER

ENTER LOWER LEFT CORNER OF DRAWING ON DIGITIZER

ENTER LOWER RIGHT CORNER OF DRAWING ON DIGITIZER

ENTER UPPER RIGHT CORNER OF DRAWING ON DIGITIZER

The cursor is next used as a pointing device to specify the numeric portion of the well identifier. To enter 10, move the cursor to a point on the menu template inside the circle labeled 1, then depress a key, then move inside the circle labeled 0, depress a key, if the maximum number of digits is greater than two then move inside the "A" circle, then depress a key to complete entry of the number 10.

Digitize data points with any key, move to circles on the menu template with number or letter corresponding to the entry that would otherwise be made using the keys of a 16 key keypad to specify function, and hit a key.

#### OPTION 4. DELETE A WELL

Selection of Option 4 from the Main Menu will clear the screen. A prompt will request:  
ENTER WELL IDENT

Enter the identifier of the well to be deleted. Continue the process of entering the identifiers of the well(s) to be deleted in response to repetitions of this prompt. To return to the Main Menu, hit the ENTER key in response to this prompt. Wells without bed records cannot be deleted.

#### OPTION 5. RECOVER A WELL

This option allows you to recover (undelete) a deleted well. After entry of 5 from the Main Menu, the screen will clear, and a prompt will request entry of the identifier (WELL IDENT) for the well to be recovered. "Undelete" wells as required. Hit the ENTER key at the ENTER WELL IDENT prompt to return operation to the main menu.

#### OPTION 6. ENTER UNIT RECORDS FOR A WELL

Selection of Option 6 from the Main Menu will clear the screen and provide a series of prompts enabling entering of unit records for wells. This option is used to enter information about the units in each well after the location of the well has been digitized.

Prompts will request the well identifier (IDENT) for a well, then the elevation of the top of the well, the total depth of the well, its bearing, and plunge.

Prompts will ask the user to supply information about the units cut by the well. Each unit identifier, depth to top, and depth to bottom, should be entered. The program will check each unit identifier to verify that it is a standard unit; its identifier must be defined in the unit identifier (bed) file.

Prompts will call for entry of the numeric variables for each unit. The numbers are separated by commas during entry. After unit information for all lithologic units has been entered, hit the ENTER key instead of providing a valid lithologic identifier to the system to the "enter a Well identifier" prompt.

Enter data for lithologic units starting with the uppermost unit and ending with the lowest unit. After entering data for the uppermost lithologic unit, if the depth to the top of the next unit (down) is the same as the depth to the bottom of the overlying unit, hit the ENTER key and this value will be entered as the default value. As shown above, numeric variables are entered by typing the number, then a comma, then the next numeric variable for the unit, then pressing the enter key to record the values. Follow the format for data entry shown by prompts on the screen.

If a unit identifier not present in the unit identifier file is specified during data entry the program will check, then call for a correct bed identifier without allowing entry of the incorrect record. The prompt INVALID BED IDENTIFIER - REENTER will be shown.

well identifiers and lithologic identifiers are case sensitive. Upper and lower case letters are different. When data entry for all wells has been completed, hit the Enter key instead of entering a new well identifier to return the system to the Main Menu.

## OPTION 7. EDIT UNIT RECORDS FOR A WELL

After a well location has been digitized and the unit record detail entered, changes to the values should be made using Option 7. After entry of 7 from the Main Menu the screen will clear and the user will be requested to enter the identifier of the well to be edited. The well identifier, latitude, longitude, top elevation, depth, bearing, and plunge, will then appear across the top of the screen and will be followed by up to ten unit records. The prompt below will be shown:

Enter Option: ?

The bottom line of the screen will display a series of options. The choices are as follows:

### 1 - CHANGE

Change the well number, top elevation, latitude, longitude, total depth, bearing, plunge, or any unit record.

### 2 - DELETE

Delete any unit record

### 3 - PRINT NEXT SECTION

Prints the next ten unit records

### 4 - INSERT AFTER

Insert a new unit record after an existing unit record

### 5 - QUIT

Returns to the well identification to edit question

Choice of Options 1-4 will bring prompts for entries as to the unit record to edit, and values to be entered. When all editing has been completed, hit the ENTER key instead of providing a well identifier at the prompt, and the system will return to the main menu.

For ease in operation use option 3, PRINT NEXT SECTION to print the record you wish to change on the screen, so that you are aware of the values being changed or inserts being made without reference to a printout. For well identifiers and lithologic identifiers upper and lower case letters are different.

## OPTION 8. LIST CONTENTS OF DATA BASE

Selection of Option 8 from the Main Menu will clear the screen. A prompt will then ask the user to indicate whether the data should be printed to the screen or to the printer. Enter S (SCREEN) or P (PRINTER). The default (hit the Enter key) is to the screen. The user is then prompted to indicate whether he wants records for a specific well or all wells. A response of ALL will create a listing of the data for all wells. Entry of a specific well identifier (WELL IDENT) will cause the program to list the data for that well, then return to the ENTER WELL IDENT prompt. After the desired wells have been listed, hitting the carriage return key instead of entering a well identifier at the ENTER WELL IDENT prompt will return operations to the Main Menu.

If the screen display is selected, data will be displayed 20 lines at a time. Prompts will be displayed at the bottom of the screen:

HIT ANY KEY TO CONTINUE LISTING (Q TO EXIT)

FUNCTION KEY 9 TO PAUSE, THEN Q TO QUIT, RETURN TO CONTINUE

If you hit Q the prompt: ENTER WELL IDENT(ALL FOR ALL, or TO QUIT will be displayed. Follow directions.

Remember that lower case and upper case letters are NOT equivalent when used in well identifiers.

## OPTION 9. PLOT STANDARD SECTION VIEW

After entering 9 from the Main Menu the screen will clear. The first prompt will request:  
**ENTER FILENAME OF PROJECTION PARAMETERS (DATABASENAME.PRJ)?**

Enter the full name of the projection parameter file; the default answer, is shown on the screen inside parentheses). Enter the full name, with extension, of the file containing the projection parameters, e.g. **UTM105.PRJ**. There is no default answer to this prompt. The next prompt will request:  
**SCREEN,PLOTTER,DISK? (S,p,d)**

Enter **S** to plot on the screen, **P** to plot on the plotter, **D** to generate an HPGL file. The default answer to this prompt is **S**.

Plot on the plotter (prompts skipped if plotting to the screen or to a disk file):

Enter **P** to plot on the plotter. A prompt will remind you that the plotter must be ready. Follow directions.

**PLOTTER SHOULD BE TURNED ON AND PAPER LOADED  
HIT ANY KEY WHEN READY**

Plot to a disk file (prompts skipped if plotting to the screen or on a plotter):

Enter **D** to generate an HPGL file to be used to drive an external program. If you enter **N**, a prompt will ask for the name of the file to be used to store the data. A file name must be entered. The prompt will ask:

**ENTER DISK FILENAME: ?**

Enter the name of the file to be created. There is no default answer to this prompt. After entry of this file name with extension, a prompt will request: **ENTER SCALING POINTS:**

**P1X,P1Y,P2X,P2Y:**

Scaling points (see p.333 and plotter documentation). are entered in the form, **80,320,10080,7520**. There is no default for these values. The values depend on the kind of plotter, the size of the plot media, and the orientation of the media in the plotter.

Plots on the screen, plotter, or to a disk file. The next prompt asks about plotting the numeric variables.

**DO YOU WANT TO PLOT THE NUMERIC VARIABLES?(y/N).**

If you answer **N** numeric variables will not be plotted and the prompt listed next will be skipped. The default answer is **N**. If you enter **Y**, the next prompt will request:

**ENTER PLOT CONTROL FILE FOR NUMERIC TRACE: ?**

Enter the filename with extension for the file that controls plotting of the numeric variables, e.g. **hist.var**. The next prompt asks for entry of the plot control file for the section:

**ENTER PLOT CONTROL FILENAME: ?**

Enter the name of the plot control file for the section. If a section is being drawn of type 1 or 2 (not type 3) see p. 266, the next prompt will request:

**CREATE AN ASCII FILE CONTAINING WELL #, DISTANCE DOWN SECTION? (y/N):**



If you wish to create an ASCII file containing the WELL IDs and the distance along the section, enter Y. The default answer is N. If you answer N the program will skip prompts related to this file and begin to operate. If you answer Y, a prompt will request entry of the complete name for the file, including extension:  
ENTER FILENAME:

After this entry or a N answer to the previous prompt the program will operate and plot the section specified.

During plotting the bottom line of the screen will display the message:  
FUNCTION KEY 9 TO PAUSE, THEN Q TO QUIT, RETURN TO CONTINUE

If you wish to stop plotting before the plot is complete, press the F9 key, then either the Return key to continue or the Q key to return operations to the main menu.

The ASCII file containing WELL IDs and distances has the format shown below. The left column contains the identifier for the wells, the right the distance in inches along the line of section. The last record is different, the first column contains blanks, the second the total distance along the section between the vertical lines.

Example:

|    |    |       |
|----|----|-------|
| T4 | ,  | 0.151 |
| T5 | ,  | 1.490 |
| T6 | ,  | 3.124 |
| "  | ", | 4.272 |

This file is included on the release disk as SECT1.ASC, and was used with SECT2.PLT to plot Fig. 37, p.292.

Vertical clip limits for the section are set by the lower and upper elevations entered for the scales at the end of the section. This permits selecting and plotting a vertically limited part of well data. The vertical clip limits apply when wells are plotted at true elevations, and also to the adjusted elevations when plotting is adjusted to a selected datum.

The unit identifier file that provides the plot patterns for each unit is specified just after the data base is opened, (Option 1 or 2 from the Main Menu). A different file can be specified by using option 2 to re-open the data base. Units in the data base that are not in the identifier file in use at the time of making the plot will not be plotted. This permits making sections that emphasize selected units by creating special versions of the unit identifier file for individual plots.

## OPTION 10. PLOT SPECIAL SECTION VIEW

Option 10 utilizes a plot control file almost identical to the Type 3 plot control file used with Option 9. Positions of wells in this type of plot control file along the section are defined in a supplementary ASCII file that can be created when drawing sections of types 1 or 2 using Option 9. For this reason, a projection file is not required. Option 10 instructs the GSLITH program to connect the first (highest) contacts between beds with lines or fill patterns, providing that the contacts below and above the unit are present in adjacent wells along the section. The user can choose whether or not to plot the drill holes and to connect contacts with lines or fill units with patterns. The tops of the wells along the ground are not connected, and the uppermost unit will not be filled, as it's upper surface is not a geologic contact between two units defined in the unit identifier file.

The prompts are as listed below for a plot on the screen. Additional prompts for plots on the plotter or to a disk file are the same as those for standard section views, Option 9, and are not repeated here.

SCREEN PLOTTER DISK? (S,p,d): ?

Enter **S** to plot on the screen, **P** to plot on the plotter, **D** to generate a disk file, the default is to the screen.

ENTER PLOT CONTROL FILENAME: ?

Enter the name of the name of the plot control file, e.g. **SECT4.PLT**.

PLOT WELLS? (Y/n): ?

the default is **Y**, yes, plot the wells.

ENTER CONNECT TYPE (l/F): ?

The default is **F**, the fill pattern for each unit will be used to connect the units in the wells.

## OPTION 11. PLOT PLAN VIEW ON THE PLOTTER (POSTING)

This option is used for all plan views, including horizontal slices drawn at levels below the land's surface. After entry of 11 from the Main Menu, the screen will clear and the user must respond to prompts. The first asks:

ENTER FILENAME OF PROJECTION PARAMETERS:

Enter the name with extension of the projection parameter file, e.g. **UTM105.PRJ**  
SCREEN,PLOTTER,DISK? (S,p,d,pr): ?

If you enter **P** (yes) output will go to the plotter, and a prompt will remind you:  
**PLOTTER SHOULD BE TURNED ON AND PAPER LOADED**  
**HIT ANY KEY WHEN READY**

If the response is **D**, prompts will request the name of a disk file where the HPGL commands (ASCII) are to be written, and then for values of the scaling points on the plotter, prompt:  
**P1X,P1Y,P2X,P2Y:**

These are the scaling points (see p. 333 and plotter documentation). They are entered in the form, **80,320,10080,7520** There is no default for these values. The values depend on the kind of plotter, the size of the plot media, and in certain cases the orientation of the media in the plotter. The values here are for the HP 7550A plotter with 8 1/2" X 11" plot media.

After entry of numeric values for the scaling points, a prompt will request:  
**ENTER PLOT CONTROL FILENAME:**

If the response is **PR** a sequence of plots will be started so that a plot can be drawn on the plotter registered to corners drawn on a sheet in the plotter (Plot Registered).

The name of the plot control file must be entered, e.g. **SECT1.PLT**. After this entry a prompt will ask:  
**DO YOU WANT TO CREATE AN ASCII FILE X,Y,Z?(Y/N) ?**

If **Y** a prompt will ask for be for the name of the file. This allow the user to export the data to programs such as gridding and contouring. The format of this file is shown on p. 258. After the entry of the file name the program will operate to make the plot.

If **N** the program will continue.

If the **PR** plot registered option is invoked, the indexing procedure will have the prompt sequence as follows:

**INSERT DIGITIZING SIGHT IN PEN POSITION 1**  
**HIT ENTER KEY ON KEYBOARD WHEN READY**

**HIT PEN UP KEY ON PLOTTER TO LOAD DIGITIZING SIGHT**  
**MOVE SIGHT TO APPROXIMATE POSITION OF NW CORNER USING PLOTTER CONTROLS,**  
**HIT PEN DOWN, MOVE TO EXACT POSITION OF NW CORNER,**  
**DIGITIZE BY HITTING ENTER KEY ON PLOTTER**  
**HIT ENTER KEY ON KEYBOARD TO CONTINUE**

This routine is continued to index the SW and SE corners of the map to the corners of the sheet in the plotter.

DIGITIZE SW CORNER  
HIT ENTER ON KEYBOARD TO CONTINUE

DIGITIZE SE CORNER  
HIT ENTER ON KEYBOARD TO CONTINUE

REMOVE DIGITIZING SIGHT AND REPLACE WITH PEN  
HIT ANY KEY TO CONTINUE

After the program operates, prompts will ask:  
DO YOU WANT TO DRAW CORNER BRACES? (y/N): ?

Enter Y to mark the corners of the plot with angle braces. The default value is N. Enter Y or N. The corners that are plotted will be the corners specified in the plot control file (not the data base corners).  
DO YOU WANT INTERNAL GEODETIC TICK MARKS? (y/N)?

Enter Y or N. The default value is N. If Y, a prompt will ask for the desired spacing:  
ENTER DELTA(DD,MM,SS):

Enter the spacing in degrees, minutes, seconds between tick marks desired, e.g. 0,2,30. Plus (+) signs will be plotted at the interval specified. After plotting the tick marks, operations will return to the Main Menu.

During plotting the bottom line of the screen will display the message:  
FUNCTION KEY 9 TO PAUSE, THEN Q TO QUIT, RETURN TO CONTINUE

If you wish to stop a plot, press the F9 key, then either the Return key to continue, or the Q key to return operations to the main menu. Units in the data base that are not in the identifier file in use at the time of plotting a horizontal slice will not be recognized or plotted.

A word of caution about the PR plot register option introduced in this version of GSLITH so that a plotter can be used to make PLAN VIEW plots registered to corners ON A SHEET. This process uses a temporary HPGL file (created, then deleted). Although you will never see this file, space must be available on the active drive so that the computer can operate and use it. Use a directory with space on a fast drive, for best results.

If the user chooses to create an ASCII file, prompts will be:  
ENTER FILENAME:  
GEODETIC OR CARTESIAN COORDINATES IN ASCII FILE  
DESTINATION? (1=GSPOST,2=GRIDDING) :

Example of an output file from PLAN2.PLT, GSPOST geodetic file format (type 1 output), plan view type 11 (horizontal slice see p. 29). Values for numeric variables will be present in the output file only for plan view type 11.

|     |    |            |              |    |    |    |        |       |       |       |      |
|-----|----|------------|--------------|----|----|----|--------|-------|-------|-------|------|
| "T1 | ", | 38.916597, | -105.715734, | 0, | 0, | 0, | 2.00,  | 1.00, | 0.00, | 0.00, | 0.00 |
| "T2 | ", | 38.905342, | -105.626636, | 0, | 0, | 0, | 3.00,  | 0.00, | 0.00, | 0.00, | 0.00 |
| "T4 | ", | 38.833354, | -105.741163, | 0, | 0, | 0, | 78.00, | 1.00, | 0.00, | 0.00, | 0.00 |
| "T5 | ", | 38.840148, | -105.662799, | 0, | 0, | 0, | 9.00,  | 2.00, | 0.00, | 0.00, | 0.00 |
| "T6 | ", | 38.828477, | -105.567157, | 0, | 0, | 0, | 4.00,  | 0.00, | 0.00, | 0.00, | 0.00 |

Example of output file from PLAN3.PLT in Cartesian coordinates for gridding (type 2 output). If multiple values are present for a well, both values will be shown in the output file in separate records, as below. Values for numeric variables will not be shown except for plan view type 11. Cartesian coordinate values will be in meters. If the projection file is a UTM file, output will be in UTM meters without 500,000 added to the X coordinate as is conventional with true UTM coordinates.

|     |    |          |           |        |
|-----|----|----------|-----------|--------|
| "T1 | ", | -62.051, | 4307.557, | 100.00 |
| "T2 | ", | -54.335, | 4306.251, | 19.92  |
| "T3 | ", | -48.891, | 4307.470, | 47.63  |
| "T4 | ", | -64.331, | 4298.337, | 55.00  |
| "T4 | ", | -64.331, | 4298.337, | 25.00  |
| "T5 | ", | -57.524, | 4299.039, | 97.00  |
| "T6 | ", | -49.231, | 4297.688, | 148.71 |

## OPTION 12. ISSUE DOS COMMAND

This option allows you to stay in a working session, yet copy files to the working area, operate a word processing program to revise plot control files, or perform other DOS functions.

The prompt is:  
ENTER DOS COMMAND, FOLLOWED BY A RETURN(RETURN ONLY TO EXIT)

Type the DOS command, then hit the ENTER key. Hit the space bar as requested, the ENTER key to return to the Main Menu.

DOS Commands such as COPY, DIR, DEL, TYPE will function as expected. The DOS command PRINT will send the file to a print buffer; this uses up memory and may cause problems. Some word processing programs can be used, others such as the DOS 5.0 editor will provide an "OUT OF MEMORY" message; try 'em and see.

## OPTION 13. EXIT

Entry of 13 from the Main Menu will return operation of the system to the DOS prompt.

## UNIT IDENTIFIER FILES

The unit identifier file (or bed file) is created with the aid of an ASCII word processing program (like SIDEKICK or non-document mode WORDSTAR). Each record (line) in the Unit Identifier File contains the identifier assigned to a particular lithologic (or stratigraphic) unit followed by parameters that define the pen and the pattern to be plotted as graphic output. A maximum of 99 different units can be specified. Each record contains the following entries separated by commas:

Unit Identifier, Up to eight alphanumeric characters, case sensitive. no blanks or commas

Pen number, 1-8, 1-6 on some plotters, 1-15 for screen colors.

Line type, 0-17, See p. 26, fig 2.

Fill type (pattern) 0-2, See p. 42, fig. 7.

Spacing between lines of fill pattern in inches.

Angle of lines, measured in degrees (+ angles counterclockwise, - angles counterclockwise).

### Example of a unit identifier file (DRILL.BED)

| FILE                  | Explanation of contents, not a part of the file           |
|-----------------------|-----------------------------------------------------------|
| L1, 1, 1, 1, .03, 0   | Unit=L1, Pen#=1, Line type=1, Fill=1, Spacing=0.03", 0°   |
| L2, 1, 0, 1, .04, 90  | Unit=L2, Pen#=1, Line type=0, Fill=1, Spacing=0.04", 90°  |
| L3, 1, 0, 1, .05, 0   | Unit=L3, Pen#=1, Line type=0, Fill=1, Spacing=0.05", 0°   |
| L4, 1, 0, 2, .03, 30  | Unit=L4, Pen#=1, Line type=0, Fill=2, Spacing=0.03", 30°  |
| L5, 1, 0, 1, .07, -30 | Unit=L5, Pen#=1, Line type=0, Fill=1, Spacing=0.07", -30° |

Units should be listed from top to bottom in this file in order of increasing age. The youngest in the first record, the oldest in the last. The sequence of listing in this file makes no difference to section or plan views, but does specify the vertical sequence (by convention arranged from top to bottom by increasing age) plotted in the legend, see fig 37, p. 292.

Please follow the format above **exactly**. Omission of a comma from this file will probably bring an error message when operating the program, following entry of the name of the file, and return the system to the DOS prompt.

The first (left hand) column of the unit identifier file contains the identifier to be used for each lithologic unit present in well data set (in this example: L1, L2, L3,L4, and L5.

The second column of the table contains the number of the pen that will be used to draw the unit, The carousel of the plotter has numbered positions. The pen called by the GSLITH program will be the pen you load into the position with that number in the carousel.

The third column designates the line type to be used in the graphical representation of the unit. The line type is specified by providing a number from 0 to 18. These line types are shown in figure 4, p. 71.

The fourth column contains the entry that specifies the fill type to be used in representation of the unit. The fill type is designated by a number, 0, 1, or 2, see examples Fig 8, p. 80.

Fill type 0 draws only the outline of the area.

Fill type 1 is a fill drawn by parallel lines.

Fill type 2 consists of two sets of mutually perpendicular parallel lines that form a rectangular grid.

The fifth column of the table contains a number that specifies the separation in inches between parallel lines drawn as polygon fills types 1, 2. Use 0 as the entry for fill type 0.

The sixth column of the table specifies the angle of the first set of parallel lines from the horizontal measured in degrees (+ angles are counterclockwise, - angles clockwise). Note that the angle zero (0) specifies horizontal lines, 90 specifies vertical lines. In the bed file, the entry in each column is ended by a comma, as shown in the example, DRILL.BED on the preceding page. Comparison of the entries in this table with the plots on figures 3, 4, and 8, may help you visualize the graphical results of these plotter instructions. See also Fig. 40, p. 295.

The last line of this file must be ended with a carriage return. There should be no blank lines at the beginning or end of this file.

## CONTROL FILE FOR NUMERIC VARIABLES

Numeric data are plotted on the right side of the plot of the well on the cross section, see Fig. 36 and 37. If numeric variables are to be plotted, a control file is needed. The first record (line) in the control file for numeric variables file is used to select the method for plotting the numeric data. Three kinds of plots can be produced. The first HIST produces a graphical record in the form of a bar graph. The outlines of the bars can be plotted alone, or the bars can be patterned. The second, TRACE, graphs the numeric variables using a line connecting values at the base of each lithologic unit. The values for the numeric variables are in the data base. Scales are specified in the control file for each of the numeric variables. Any or all of the numeric variables can be plotted on a single plot. Scales are separately set for each of the variables. The third kind of plot LABEL plots the value of a single selected variable to the right of the plot of the well, just above the base of the unit.

Record 1. The first record is **HIST**, **TRACE**, or **LABEL**

HIST produces a bar graph.

TRACE graphs a line connecting values at the base of each lithologic unit.

Label plots the value of a single selected variable at the base of each lithologic unit.

After Record 1, one additional record is needed for each variable in the data base. The first (record 2) sets parameters for Variable 1, the second (record 3) for Variable 2, and so on. Up to 5 numeric variables are allowed. The number of records specifying plot parameters for numeric variables must match the number of numeric variables in the data base to be plotted. The examples below provide specifications for the contents of each record.

Each record for a numeric variable control file using the **TRACE** method consists of the following, separated by commas:

Pen number (position in carousel)

Line type (number)

Base value for numeric variable (value plotted along the right side of the well)

Units per inch for graph of numeric variable

Each record for a numeric variable control file using the **HIST** method consists of the following, separated by commas:

Pen number (position in carousel)

Line type (number)

Base value for numeric variable (value plotted along the right side of the well)

Units per inch for graph of numeric variable

Fill type (number, 0-2)

Spacing between lines in inches

Angle of rotation in degrees

.

Examples of plot control files for numeric variables

### TRACE

| FILE      | EXPLANATION                                                     |
|-----------|-----------------------------------------------------------------|
| TRACE     | TRACE selects the numeric trace option                          |
| 1,0,0,100 | 1 (Pen=1), Line type=0,Base value=0,Units/inch=100 "Variable 1" |
| 2,1,0,100 | 2 (Pen=2), Line type=1,Base value=0,Units/inch=100 "Variable 2" |
| 1,0,0,80  | 3 (Pen=1), Line type=0,Base value=0,Units/inch=80 "Variable 3"  |
| 2,3,0,100 | 4 (Pen=2), Line type=3,Base value=0,Units/inch=100 "Variable 4" |



## HIST

| File               | EXPLANATION                                                                       |
|--------------------|-----------------------------------------------------------------------------------|
| HIST               | HIST selects the bar graph option                                                 |
| 0,100,2,1,1,.03,45 | Base value=0,Units/inch=100,Pen=2,Line type=1,Fill=#1,Spacing=.03",angle=45 Var#1 |
| 0, 0,1,1,1,.01,0   | Base value=0,Units/inch=0,Pen=1,Line type=1,Fill=#1,Spacing=0.01",angle=0 Var#2   |
| 0, 50,1,1,1,.01,0  | Base value=0,Units/inch=50,Pen=1,Line type=1,Fill=#1,Spacing=0.01", angle=0 Var#3 |
| 0, 80,1,1,2,.01,0  | Base value=0,Units/inch=80,Pen=1,Line type=1,Fill=#2,Spacing=0.01",angle=0 Var#4  |

If you do NOT want to plot a particular numeric variable, set the scale for that variable to 0 (Zero), see variable #2 in file HIST above.

Examples of line types are shown on Fig. 2, p. 26.

## LABEL

| File        | EXPLANATION                                                  |
|-------------|--------------------------------------------------------------|
| LABEL       | LABEL selects the label option                               |
| 1,2,.04,.06 | Variable #=1,Pen=2,Width of label=.04", height of label=0.6" |

## PLOT CONTROL FILES FOR CROSS SECTIONS

Plot control files are required for making plots using GSLITH. For plots of sections these files specify the plot parameters. These files must be written by the user. The plot control file consists of a series of ASCII records in a file with a name specified by the user. Each record is a single line of data items separated by commas and ended by a carriage return. Examples of plot control files are included on the disk of this release.

### Types of cross sections

1 = Beginning and ending points to be specified by latitude, longitude coordinates and well data to be projected (perpendicularly) to this cross-section line if the wells are located within a specified distance (in feet) of this line of section. Wells are plotted with correct plunge (apparent plunge along plane of section compensated for vertical and horizontal scale).

2 = Beginning (left) and ending points (right) of the section specified by latitude, longitude coordinates and wells specified by well identifier (ID) projected (perpendicularly) to this line of cross section. Wells are plotted with correct plunge (apparent plunge along plane of section adjusted for vertical and horizontal scale).

3 = An ASCII text file specifies the beginning and ending points of the cross-section (inches along the cross section), the wells to be plotted by well identification, and the positions of their plots along the cross section. Wells are plotted as if vertical.

4 = An ASCII text file specifies the beginning and ending points of the cross-section (inches along the cross section), the wells to be plotted by well identification, and the positions of their plots along the cross section. Wells are plotted as if vertical. Type 4 sections are used with Option 10, to produce special sections on which contacts or units are connected from well to well see file SECT4.PLT.

The ASCII file can be generated while making sections of Type 1 or 2; alternatively it can be written using a word processing program. The file on the left is in the format written by GSLITH. The file on the right has a format more convenient for a word processing program. Both work.

|     |    |       |
|-----|----|-------|
| T12 | ,  | 0.250 |
| T22 | ,  | 0.751 |
| T32 | ,  | 1.249 |
| T42 | ,  | 1.751 |
| T62 | ,  | 2.749 |
| "   | ", | 3.750 |

|           |
|-----------|
| T12,0.250 |
| T22,0.751 |
| T32,1.249 |
| T42,1.751 |
| T62,2.749 |
| " ",3.750 |

### Section type 1

Record 1 specifies the type of the cross section to be drawn, e.g. 1.

Record 2 specifies the base elevation, top elevation, vertical scale, tick mark interval on the scale, and the width of the well column in inches. The program will construct a vertical scale on the left and right sides of the cross-section. The scale will be labeled on even multiples of the vertical scale, e.g. 3600,4600,200,100,0.20.

Record 3 specifies the horizontal scale. The scale is expressed as the denominator of the scale fraction. If the base map is plotted at 1:24000 a same-scale section would be drawn by specifying a scale of 24000.0, e.g. 24000.

Record 4 specifies the offset, in inches, of the lower left corner of the cross section from the default position of the plotter on the paper, e.g. 1,1.2.

Record 5 contains an entry of Y or N specifying whether or not the plot is to be rotated by the plotter, e.g. Y

Record 6 specifies the speed and force at which the plotter is to draw the map or cross-section. Normally the

speed is 12 centimeters per second (cps) for final drawings and up to 55 cps for drafts. Minimal force is generally used to minimize wear on the pen points (value of 1 or 2), e.g. 25,2.

Record 7 specifies the width and height, in inches for plotted letters and numbers, e.g. 0.04,0.06.

Record 8 specifies parameters that determine (1) whether the plots of well data are drawn to their correct elevation (based on the elevation entered for the top of the hole); (2) are to be aligned at a specified elevation for the bottom of a chosen unit if it was encountered in the hole; or (3) are to be aligned at a specified elevation on the contact of two specified units.

- To draw plots that show wells at their actual elevation, enter "NOSTRAT",,0 for Record 8.
- To draw plots of wells in which the bottom of the uppermost occurrence of a unit is drawn at a specified elevation, enter the unit identifier and the elevation desired: Example Or,,1000 for Record 8.
- To draw plots that show wells in which a contact is fixed at a specified elevation, enter the two unit identifiers and the elevation desired: Example Or,Oc,1000. A plot of the well will be drawn only if both units are present in the well and the depth of the base of the first unit (here Or) matches the depth of the top of the second unit (here Oc).

Record 9 specifies whether or not a legend is to be plotted. To plot a legend, enter Y and the position of the top left corner (location in inches) where the legend is to be plotted; to not plot a legend, enter N,0,0

- To plot a legend with top at position X=6",Y=9" on the sheet, enter Y,6,9
- To make a plot without a legend, enter N,0,0. Legend boxes are always drawn the same height. Changing the scale of a plot does not change the height of the boxes. The width of the boxes is determined by the width specified for the wells.

Record 10 specifies the starting point of the cross section (left end) in latitude, longitude coordinates e.g. 38,0,0,N,105,0,0,W

Record 11 specifies the ending point of the cross section (right end) using latitude, longitude coordinates, e.g. 38,30,10,N,110,15,10,W

Record 12 specifies the distance (in feet) on both sides of the line of section to be used to select wells to be drawn on the cross-section, e.g. 1000

Example of a plot control file for a section of type 1, annotations on the right are not a part of the file.

|                         |                                                                                            |
|-------------------------|--------------------------------------------------------------------------------------------|
| 1                       | Section type 1                                                                             |
| -6000,5000,500,100,0.25 | Top=-6000',Base=5000',Vertical scale=500'/in.,tick mark interval=100', width of well=0.25" |
| 24000                   | Horizontal scale=1:24000                                                                   |
| 1,1                     | XOFF=1",YOFF=1"                                                                            |
| N                       | No, don't rotate on plotter                                                                |
| 12,2                    | Speed=12, Force=2                                                                          |
| 0.1,0.15                | Width=0.1". Height=0.15" for label characters                                              |
| "CACHE",,2800           | Adjust base of unit Cache to 2800'                                                         |
| Y,30,14                 | Yes,plot legend, top at X=30" Y=14"                                                        |
| 44,25,0,N,105,37,30,W   | Coordinates left end of section                                                            |
| 44,25,0,N,105,30,00,W   | Coordinates right end of section                                                           |
| 3000                    | Plot wells within 3000' of line of cross section on plan view                              |

## Section type 2

Record 1 specifies the type of the cross section to be drawn, e.g. 2.

Record 2 specifies the base elevation, top elevation, vertical scale, tick mark interval on the scale, and the width of the well column in inches. The program will construct a vertical scale on the left and right sides of the cross-section. The scale will be labeled on even multiples of the vertical scale, e.g. 3600,4600,200,100,0.20.

Record 3 specifies the horizontal scale. The scale is expressed as the denominator of the scale fraction. If the base map is plotted at 1:24000 a same-scale section would be drawn by specifying a scale of 24000.0, e.g. 240000.

Record 4 specifies the offset, in inches, of the lower left corner of the cross section from the default position of the plotter on the paper, e.g. 1,1.2.

Record 5 contains an entry of Y or N specifying whether or not the plot is to be rotated by the plotter, e.g. Y

Record 6 specifies the speed and force at which the plotter is to draw the map or cross-section. Normally the speed is 12 centimeters per second (cps) for final drawings and up to 55 cps for drafts. Minimal force is generally used to minimize wear on the pen points (value of 1 or 2), e.g. 25,2.

Record 7 specifies the width and height, in inches for plotted letters and numbers, e.g. 0.04,0.06.

Record 8 specifies parameters that determine (1) whether the plots of well data are drawn to their correct elevation (based on the elevation entered for the top of the hole); (2) are to be aligned at a specified elevation for the bottom of a chosen unit if it was encountered in the hole; or (3) are to be aligned at a specified elevation on the contact of two specified units.

- To draw plots that show wells at their actual elevation, enter "NOSTRAT",0 for Record 8.

- To draw plots of wells in which the bottom of the uppermost occurrence of a unit is drawn at a specified elevation, enter the unit identifier and the elevation desired: Example Or,,1000 for Record 8.

- To draw plots that show wells in which a contact is fixed at a specified elevation, enter the two unit identifiers and the elevation desired: Example Or,Oc,1000. A plot of the well will be drawn only if both units are present in the well and the depth of the base of the first unit (here Or) matches the depth of the top of the second unit (here Oc).

Record 9 specifies whether or not a legend is to be plotted. To plot a legend, enter Y and the position of the top left corner (location in inches) where the legend is to be plotted; to not plot a legend, enter N,0,0

- To plot a legend with top at position X=6",Y=9" on the sheet, enter Y,6,9

- To make a plot without a legend, enter N,0,0. Legend boxes are always drawn the same height. Changing the scale of a plot does not change the height of the boxes. The width of the boxes is determined by the width specified for the wells.

Record 10 specifies the starting point of the cross section (left end) in latitude, longitude coordinates e.g. 38,0,0,N,105,0,0,W

Record 11 specifies the ending point of the cross section (right end) using latitude, longitude coordinates, e.g. 38,30,10,N,110,15,10,W

Record 12 and following records list well identifiers, one to each record in the file. Wells in this list will be projected to the line of section.

Example of a plot control file for a section of type 2, annotations on the right are not a part of the file.

|                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre> 2 -6000,5000,500,100,0.25 24000 1,1 N 12,2 0.1,0.15 "CACHE",,2800 Y,30,14 44,25,0,N,105,37,30,W 44,25,0,N,105,30,00,W T120 T142 T154 </pre> | <pre> Section type 2 Top=-6000',Base=5000',Vertical scale=500'/in.,tick mark interval=100', width of well=0.25" Horizontal scale=1:24000 XOFF=1",YOFF=1" No, don't rotate on plotter Speed=12, Force=2 Width=0.1". Height=0.15" for label characters Adjust base of unit Cache to 2800' Yes,plot legend, top at X=30" Y=14" Coordinates left end of section Coordinates right end of section Project well T120 to the line of section Project well T142 to the line of section Project well T154 to the line of section </pre> |
|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### Section type 3

- Record 1 specifies the type of the cross section to be drawn, e.g. 3.
- Record 2 specifies the base elevation, top elevation, vertical scale, tick mark interval on the scale, and the width of the well column in inches. The program will construct a vertical scale on the left and right sides of the cross-section. The scale will be labeled on even multiples of the vertical scale, e.g. 3600,4600,200,100,0.20.
- Record 3 specifies the horizontal scale. The scale is expressed as the denominator of the scale fraction. If the base map is plotted at 1:24000 a same-scale section would be drawn by specifying a scale of 24000.0, e.g. 240000.
- Record 4 specifies the offset, in inches, of the lower left corner of the cross section from the default position of the plotter on the paper, e.g. 1,1.2.
- Record 5 contains an entry of Y or N specifying whether or not the plot is to be rotated by the plotter, e.g. Y
- Record 6 specifies the speed and force at which the plotter is to draw the map or cross-section. Normally the speed is 12 centimeters per second (cps) for final drawings and up to 55 cps for drafts. Minimal force is generally used to minimize wear on the pen points (value of 1 or 2), e.g. 25,2.
- Record 7 specifies the width and height, in inches for plotted letters and numbers, e.g. 0.04,0.06.
- Record 8 specifies parameters that determine (1) whether the plots of well data are drawn to their correct elevation (based on the elevation entered for the top of the hole); (2) are to be aligned at a specified elevation for the bottom of a chosen unit if it was encountered in the hole; or (3) are to be aligned at a specified elevation on the contact of two specified units.
- To draw plots that show wells at their actual elevation, enter "NOSTRAT",,0 for Record 8.
  - To draw plots of wells in which the bottom of the uppermost occurrence of a unit is drawn at a specified elevation, enter the unit identifier and the elevation desired: Example Or,,1000 for Record 8.
  - To draw plots that show wells in which a contact is fixed at a specified elevation, enter the two unit identifiers and the elevation desired: Example Or,Oc,1000. A plot of the well will be drawn only if both units are present in the well and the depth of the base of the first unit (here Or) matches the depth of the top of the second unit (here Oc).
- Record 9 specifies whether or not a legend is to be plotted. To plot a legend, enter Y and the position of the top left corner (location in inches) where the legend is to be plotted; to not plot a legend, enter N,0,0
- To plot a legend with top at position X=6",Y=9" on the sheet, enter Y,6,9
  - To make a plot without a legend, enter N,0,0. Legend boxes are always drawn the same height. Changing the scale of a plot does not change the height of the boxes. The width of the boxes is determined by the width specified for the wells.
- Record 10 specifies the starting point of the cross section (left end) in latitude, longitude coordinates e.g. 38,0,0,N,105,0,0,W
- Record 11 specifies the ending point of the cross section (right end) using latitude, longitude coordinates, e.g. 38,30,10,N,110,15,10,W
- Record 12 specifies the complete name of an ASCII file that specifies wells, plot position, and length of section.

Example of a plot control file for a section of type 3, annotations on the right are not a part of the file.

|                         |                                                                                            |
|-------------------------|--------------------------------------------------------------------------------------------|
| 3                       | Section type 3                                                                             |
| -6000,5000,500,100,0.25 | Top=-6000',Base=5000',Vertical scale=500'/in.,tick mark interval=100', width of well=0.25" |
| 24000                   | Horizontal scale=1:24000                                                                   |
| 1,1                     | XOFF=1",YOFF=1"                                                                            |
| N                       | No, don't rotate on plotter                                                                |
| 12,2                    | Speed=12, Force=2                                                                          |
| 0.1,0.15                | Width=0.1". Height=0.15" for label characters                                              |
| "CACHE",,2800           | Adjust base of unit Cache to 2800'                                                         |
| Y,30,14                 | Yes,plot legend, top at X=30" Y=14"                                                        |
| 44,25,0,N,105,37,30,W   | Coordinates left end of section                                                            |
| 44,25,0,N,105,30,00,W   | Coordinates right end of section                                                           |
| WELLS.LST               | Plot wells as listed in file Wells.LST                                                     |

If adjustment of elevation of wells based on a particular unit or contact is specified that unit or contact

must be present in a well or that well will not be plotted. Deleted wells will not be plotted.

## PLOT CONTROL FILES FOR PLAN VIEWS

Plot control files for plan views (maps) consist of a series of ASCII records that specify the parameters for the plot.

### Types of plan views

- 0 = Symbol plotted at the position of the well, no posting.
- 1 = Well Identification (symbol plotted at the position of the well, posting just to the right of the top of the well).
- 2 = Elevation at the top of the well (symbol plotted at the position of the well, posting just to the right of the top of the well).
- 3 = Elevation at the bottom of the well (symbol plotted at the position of the well, posting just to the right of the top of the well).
- 4 = Depth of the well, (symbol plotted at the position of the well, posting just to the right of the top of the well).
- 5 = Elevation at the top of a unit, (symbol plotted at the position of the well, posting just to the right of the top of the well).
- 6 = Elevation at the bottom of a unit (symbol plotted at the position of the well, posting just to the right of the top of the well).
- 7 = Thickness of a unit (symbol plotted at the position of the well, posting just to the right of the top of the well).
- 8 = Elevation of a contact between two units (symbol plotted at the position of the well, posting just to the right of the top of the well).
- 9 = Thickness of a unit between two contacts (symbol plotted at the position of the well, posting just to the right of the top of the well).
- 10 = The computed vertical offset necessary for stratigraphic alignment (symbol plotted at the position of the well, posting just to the right of the top of the well). (See Note Below)
- 11 = Plot horizontal slice at a specified elevation (no posting), square filled with pattern designated for unit plotted at true position for specified elevation.

If elevations are adjusted to the base of a rock unit, contact, or other horizon, the posted values are relative to the fixed elevation for the selected horizon.

### Contents of plan view plot control files

- Record 1 specifies the type of plan view, and the kind of value to be posted, e.g. 2
- Record 2 specifies the latitude, longitude coordinates of the NW corner of the area, e.g. 38,0,0,N,106,0,0,W.
- Record 3 specifies the latitude, longitude coordinates of the SW corner of the area, e.g. 37,0,0,N,106,0,0,W
- Record 4 specifies the latitude longitude coordinates of the SE corner of the area, e.g. 38,0,0,N,105,0,0,W
- Record 5 specifies the latitude, longitude coordinates of the NE corner of the area, e.g. 39,0,0,N,106,0,0,W
- Record 6 specifies the map scale for the X and Y directions, e.g. 24000,24000. The scale is given as the denominator of the scale fraction.
- Record 7 specifies the offset (in inches) from the plot corner of the paper where the SW corner of the map is to be drawn, e.g. 1,2
- Record 8 indicates whether the plot is to be rotated on the plotter paper, Y=Rotate, N=Don't rotate, e.g. Y Rotate plot.
- Record 9 specifies the speed and force at which the plotter is to draw the map or section. Normally the speed is 15 centimeters per second (cps) or less for drawings using technical pens and ink, and up to 55 cps for drafts using fibertip pens. Minimal force is generally used to minimize wear on the pen points, value of 1 or 2, e.g. 25,2
- Record 10 specifies the size (width and height) in inches of the characters that are posted, e.g. 0.1,0.15

Record 11 contains the specifications that control the vertical parameters of data. Vertical positioning can be based on the elevation of the top of the well (true elevation), on a selected (and fixed) elevation for the bottom of a unit, or on a fixed elevation for the contact between two units.

- If plots are to be based on the elevations of the well tops (true elevations without adjustment), the entry is: "NOSTRAT",0
- If plots are to be based on the elevation of the bottom of the uppermost occurrence of a unit (adjustments based on that position), the entry is the unit identifier, a second comma, and the elevation specified for alignment, e.g. Or,,1000
- If plots are to be aligned at a stratigraphic contact, the entry consists of the identifier of the upper unit, followed by the identifier of the lower unit, followed by the elevation chosen for that contact on the diagram, e.g. "Ocs","Or",1000

#### Record 12

- For plan view types 0-10 as defined in record 1 of the plot control file, record # 12 specifies the pen number to be used, the symbol number and the size of the symbol in units of 1/1000 inch, e.g. 1,5,35 (specifies pen number 1, symbol type 5 at a size of 35/1000 inch.
- For plan view type 11, record #12 specifies the elevation of the horizontal slice and the length of the sides of the square to be plotted in inches, e.g. 9600,0.2

Record 12 is the final record for plans types 0-4 and 10 and 11.

#### Record 13

- For plan view types 5-9, as defined in record 1 of the plot control file: This record (#13) specifies the unit or contact (upper contact for type 9) contact. For a single unit, plan view types 5, 6, 7, the unit ID followed by a comma, e.g. "Or",
- For a plan view related to a contact (plan view types 8, 9, the two unit IDs separated by a comma, e.g. "Ocs","Or".

Record 13 is the final record for plans types 5-8.

#### Record 14

For plan view type 9, this final record specifies the 2nd (lower) contact, e.g. "Or","Oj"

Example of a plot control file for a plan view of type 1, plot symbol and post well identifiers

|                        |                                                  |
|------------------------|--------------------------------------------------|
| File                   | Explanation of contents (not a part of the file) |
| 1                      | Plan type 1                                      |
| 44,30,00,N,105,37,30,W | Coordinates NW corner of plot                    |
| 44,22,30,N,105,37,30,W | Coordinates SW corner of plot                    |
| 44,22,30,N,105,30,0,W  | Coordinates SE corner of plot                    |
| 44,30,0,N,105,30,0,W   | Coordinates NE corner of plot                    |
| 100000,100000          | XSCALE=1:100000, YSCALE=1:100000                 |
| 0,0                    | XOFF=0, YOFF=0                                   |
| Y                      | Yes, rotate on plotter                           |
| 25,2                   | Speed=25, Force=2                                |
| 0.1,0.15               | Width=0.1",Height=0.15" for label characters     |
| "NOSTRAT",,0           | Do not adjust elevations                         |
| 1,77,50                | Pen=1, Symbol#=77, Size=50/1000"                 |

Example of a plot control file for a plan view of type 9, plot symbol, post thickness between two contacts.

|                        |                                                  |
|------------------------|--------------------------------------------------|
| File                   | Explanation of contents (not a part of the file) |
| 9                      | Plan type 9                                      |
| 44,30,00,N,105,37,30,W | Coordinates NW corner of plot                    |
| 44,22,30,N,105,37,30,W | Coordinates SW corner of plot                    |
| 44,22,30,N,105,30,0,W  | Coordinates SE corner of plot                    |
| 44,30,0,N,105,30,0,W   | Coordinates NE corner of plot                    |
| 100000,100000          | XSCALE=1:100000, YSCALE=1:100000                 |
| 0,0                    | XOFF=0, YOFF=)                                   |
| Y                      | Yes, rotate on plotter                           |
| 25,2                   | Speed=25, Force=2                                |
| 0.1,0.15               | Width=0.1",Height=0.15" for label characters     |
| "NOSTRAT",,0           | Do not adjust elevations                         |
| 1,77,50                | Pen=1, Symbol#=77, Size=50/1000"                 |
| "Oocs", "Or"           | Upper contact= Oocs/Or                           |
| "Or", "Oj"             | Lower contact= Or/Oj                             |

Example of a plot control file for a plan view of type 11, horizontal slice at a specified elevation

|                        |                                                  |
|------------------------|--------------------------------------------------|
| File                   | Explanation of contents (not a part of the file) |
| 11                     | Plan type 11                                     |
| 44,30,00,N,105,37,30,W | Coordinates NW corner of plot                    |
| 44,22,30,N,105,37,30,W | Coordinates SW corner of plot                    |
| 44,22,30,N,105,30,0,W  | Coordinates SE corner of plot                    |
| 44,30,0,N,105,30,0,W   | Coordinates NE corner of plot                    |
| 100000,100000          | XSCALE=1:100000, YSCALE=1:100000                 |
| 0,0                    | XOFF=0, YOFF=)                                   |
| Y                      | Yes, rotate on plotter                           |
| 25,2                   | Speed=25, Force=2                                |
| 0.1,0.15               | Width=0.1",Height=0.15" for label characters     |
| "NOSTRAT",,0           | Do not adjust elevations                         |
| 1,77,50                | Pen=1, Symbol#=77, Size=50/1000"                 |
| 5280,0.15              | Slice at elevation=5280, square side=0.15"       |



## GSLUTIL

The GSLUTIL program has fourteen options for use with GSLITH data bases. These options assist the user of this program in working with data bases.

- SELECT A SUBSET BY WELL ID INTO OUTPUT DATA BASE
- CONVERT INPUT DATA BASE INTO AN ASCII FILE
- READ AN ASCII FILE AND CREATE OUTPUT DATA BASE
- TRIM ON POLYGONAL BORDER DEFINED IN AN ASCII FILE
- MERGE MULTIPLE INPUT DATA SETS INTO ONE OUTPUT DATA SET
- SELECT WELLS THAT CONTAIN ONE OR MORE SPECIFIED BEDS
- SAME AS 6, BUT OUTPUT ONLY THE SPECIFIED BEDS
- DELETE WELLS WITH FAULTY LATLON, TOP ELEV, TOTAL DEPTH
- CHECK BED IDS AGAINST LIST IN AN ASCII FILE
- GENERATE FILE WITH ALL BED IDENTIS
- REPLACE BED IDENTIS WITH DIFFERENT BED IDENTIS
- CONVERT VERSION 8 GSLITH DATA BASES TO VERSION 9
- CONVERT VERSION 1 GSLXY DATA BASES TO VERSION 9

The program file GSLUTIL.EXE must be in the default area or the current path. No configuration files are required. Several of the options require the user to prepare an ASCII text file before operating the program. These files can be prepared using any word processing program that can produce ASCII files.

GSLUTIL is started by entering GSLUTIL on the keyboard while at the DOS prompt and pressing the ENTER key. The screen will briefly display a disclaimer message and then shift to the main menu prompting a series of choices.

```

      G S L U T I L
      Version 9.00

1 - SELECT A SUBSET BY WELL ID INTO OUTPUT DATA BASE
2 - CONVERT INPUT DATA BASE INTO AN ASCII FILE
3 - READ AN ASCII FILE AND CREATE OUTPUT DATA BASE
4 - TRIM ON POLYGONAL BORDER DEFINED IN AN ASCII FILE
5 - MERGE MULTIPLE INPUT DATA SETS INTO ONE OUTPUT DATA SET
6 - SELECT WELLS THAT CONTAIN ONE OR MORE SPECIFIED BEDS
7 - SAME AS 6, BUT OUTPUT ONLY THE SPECIFIED BEDS
8 - DELETE WELLS WITH FAULTY LATLON, TOP ELEV, TOTAL DEPTH
9 - CHECK BED IDS AGAINST LIST IN AN ASCII FILE
10 - GENERATE FILE WITH ALL BED IDENTIS
11 - REPLACE BED IDENTIS WITH DIFFERENT BED IDENTIS
12 - CONVERT VERSION 8 GSLITH DATA BASES TO VERSION 9
13 - CONVERT VERSION 1 GSLXY DATA BASES TO VERSION 9
14 - EXIT

      ENTER CHOICE BY NUMBER:
```

Select the option desired by typing the number on the left side of the menu and pressing the ENTER key.  
(ENTER CHOICE BY NUMBER).

Selection of an option will bring prompts for additional information to be entered from the keyboard.

## OPTION 1 - SELECT A SUBSET BY WELL ID INTO OUTPUT DATA BASE

This option allows the user to select data on wells from an input data base by specifying the well identifier(s) in an ASCII file, and copy all information on wells on the list to an output data base.

The user should prepare an ASCII file containing the well identifiers (one per line) in advance. The program will request information in response to the following prompts:

ENTER INPUT DATA BASE NAME:

ENTER FILENAME FOR WELLS TO BE SELECTED:

ENTER OUTPUT DATA BASE NAME:

The program will pause listing the number of wells selected within the ASCII file and the number of wells that were found and written to the output data base. The user is requested to press ENTER to return to the main menu.

Example of ASCII well selection file.

|          |
|----------|
| BIRN0001 |
| SHER0118 |
| BUFF1016 |

Each line must end with a carriage return.

## OPTION 2 - CONVERT INPUT DATA BASE INTO AN ASCII FILE

This option allows a user to prepare an ASCII file containing all of the information in the data base. This file can be edited using an ASCII text processing program, then converted back to a GSLITH data base using Option 3. The program will request responses to the following prompts:

ENTER INPUT DATA BASE NAME:

ENTER FILENAME FOR OUTPUT ASCII DATA:

The resulting ASCII file will contain information for all wells in the format shown in the example. The number of bed records for each well will vary, depending on the data in the data base.

Example:

```
TITLE
45.5 -108
42.5 -108
42.5 -104
45.5 -104
0
SHER0118 , 44.86167 -106.49695 4187 9750 0 90 13
T , 0 4460
Kl , 4460 5254
Kfh , 5254 5378
Kp , 5378 7654
Kn , 7654 7840
Kcl , 7840 7945
Kf , 7945 8384
Kbf , 8384 8984
KbfB1 , 8588 8594
KbfB2 , 8674 8677
Kmw , 8984 9370
Ktm , 9400 9649
KdKlk , 9649 9750
```

## OPTION 3 - READ AN ASCII FILE AND CREATE OUTPUT DATA BASE

This option allows the user to convert a properly formatted ASCII file into a GSLITH data base. The user must prepare the input file using a word processing program that is capable of producing an ASCII file or generate the file using a data base manager such as dBASE, or a spreadsheet program such as LOTUS 1-2-3. The format of the file is identical to the format of the file produced by Option 2, GSMUTIL. Turn your plotter on before running this option. Problems with the ASCII file will be noted on the printer.

The program will request responses to the following prompts:

ENTER INPUT FILENAME OF ASCII DATA:

ENTER OUTPUT DATA BASE NAME:

Operation will return to the main menu when finished.

#### OPTION 4 - TRIM ON POLYGONAL BORDER DEFINED IN AN ASCII FILE

This option allows the user to select those wells from an input data base that fall within a closed polygon defined by points in an ASCII file (geographic trimming), and write data for these wells to an output data base. The program will request responses to the following prompts:

ENTER INPUT DATA BASE NAME:

ENTER FILENAME OF POLYGON BORDER POINTS:

DO YOU WANT THE MIN AND MAX OF THE POLYGON AS  
THE OUTPUT DATA BASE CORNERS?(Y/N):

ENTER OUTPUT DATA BASE NAME:

ENTER TITLE FOR OUTPUT DATA BASE:

If the user responses N to the question regarding the minimum and maximum of the polygon, the program will use the corners of the input data base as the values of the corners of the output data base. The user must ensure that the polygon closes by repeating the coordinates of the first point for those of the last point. The trim polygon is limited to 1500 points. GSMAP can be used to prepare such a polygon trim file. Digitize the outline, convert the binary GSMAP data base to an ASCII file using GSMUTIL, then delete header records using a text editing program.

Example of polygon trim file

|           |             |
|-----------|-------------|
| 38.116938 | -105.700716 |
| 38.119254 | -105.699191 |
| 38.121216 | -105.697482 |
| 38.122787 | -105.696153 |
| 38.123770 | -105.694567 |
| 38.127394 | -105.690860 |
| 38.113202 | -105.702973 |
| 38.115120 | -105.701623 |
| 38.116314 | -105.701044 |
| 38.116938 | -105.700716 |

## OPTION 5 - MERGE MULTIPLE INPUT DATA SETS INTO ONE OUTPUT DATA SET

This option allows the user to combine several input data bases into a single output data base. The output data base will contain all wells from each of the input data bases and all of the associated information for each well. Data from deleted wells will not be copied into the merged data base.

The program will request responses to the following prompts which set up parameters for the output data base:

ENTER OUTPUT DATA BASE NAME:

ENTER TITLE FOR OUTPUT DATA BASE:

ENTER LAT,LON OF NW CORNER  
DD,M,SS,C,DDD,MM,SS,C:

ENTER LAT,LON OF SW CORNER  
DD,M,SS,C,DDD,MM,SS,C:

ENTER LAT,LON OF SE CORNER  
DD,M,SS,C,DDD,MM,SS,C:

ENTER LAT,LON OF NE CORNER  
DD,M,SS,C,DDD,MM,SS,C:

ENTER THE NUMBER OF NUMERIC VARIABLES:

The next prompts, as many as needed, call for the names of the data bases to be merged in the output data base:

ENTER INPUT DATA BASE NAME:

ENTER INPUT DATA BASE NAME:

ENTER INPUT DATA BASE NAME:

When all required input data bases have been added to the output data base, hit the ENTER key instead of entering a data base name to return operations to the main menu screen..

## OPTION 6 - SELECT WELLS THAT CONTAIN ONE OR MORE SPECIFIED BEDS

This option allows the user to select wells from an input data base that contain one or more beds from a specified list and generate an output data base containing only these selected wells. An ASCII file that is prepared in advance contains the identifiers for the selected units. All data for each selected well is copied into the output data base. The program will request responses to the following prompts:

ENTER INPUT DATA BASE NAME:

ENTER FILENAME FOR SELECTED BEDS:

ENTER OUTPUT DATA BASE NAME:

ENTER TITLE FOR OUTPUT DATA BASE:

The program will use the corners of the input data base as the corners of the output data base.

Example of SELECTED BED file:

|     |
|-----|
| Kmw |
| Kcl |
| Kp  |

## OPTION 7 - SAME AS 6, BUT OUTPUT ONLY THE SPECIFIED BEDS

This option allows the user to select wells containing one or more beds from a specified list and write data for the selected beds (only) for the selected wells into an output data base. An ASCII file that is prepared in advance lists the identifiers for the selected units. Option 7 differs from Option 6 in that only the data for the listed beds will be written into the output data base. The purpose of this option is to prepare a data base for a specific purpose that contains only the information needed so that it can be used quickly. The same "selected bed file is used as for the previous option. The program will request responses to the following prompts:

ENTER INPUT DATA BASE NAME:

ENTER FILENAME FOR SELECTED BEDS:

ENTER OUTPUT DATA BASE NAME:

ENTER TITLE FOR OUTPUT DATA BASE:

The corners of the output data base will be identical to the corners of the input data base.

## OPTION 8 - DELETE WELLS WITH FAULTY LATLON, TOP ELEV, TOTAL DEPTH

This option enables automatic deletion of wells with certain types of faulty data. It allows the user to copy an input data base to an output data base, deleting (not copying) wells for which one or more of the following conditions are true:

1. Latitude = 0 and Longitude = 0
2. Collar elevation = 0
3. Total depth = 0

The program will request responses to the following prompts:

ENTER INPUT DATA BASE NAME:

ENTER OUTPUT DATA BASE NAME:

ENTER TITLE FOR OUTPUT DATA BASE:

The corners of the output data base will be identical to the corners of the input data base.

## OPTION 9 - CHECK BED IDS AGAINST LIST IN AN ASCII FILE

This option allows the user to check the bed identifiers of each well in an input data base against a specified list of bed identifiers contained in an ASCII file. The list of beds is specified in an ASCII file that is prepared in advance. The program will print (on the hard-copy printer) a list of all beds that appear in the input data base but are not contained in the ASCII list. The output list contains the well identifier and the identifier of the unknown bed. The same selected bed file is used as for the previous two options.

The program will request responses to the following prompts:

ENTER INPUT DATA BASE NAME:

ENTER FILENAME FOR SELECTED BEDS:

EXAMPLE OF SELECTED BED FILE

|     |
|-----|
| Kmw |
| Kcl |
| Kp  |

## OPTION 10 - GENERATE FILE WITH ALL BED IDENTIS

This option allows the user to generate a file listing all bed identifiers that occur in an input data base. The list includes the bed identifier, the number of wells containing the bed, the average thickness, the minimum thickness and maximum thickness, for each bed. The list identifies which wells that contain the minimum and maximum thickness for each unit. When computing the mean, minimum and maximum, then program will only use bed records that are not the first or last record for an individual well. The count will include all occurrences including first and last records. This list is useful in stratigraphic analysis and serves also as to help edit a data base. The list is written to an output ASCII file.

The program will request responses to the following prompts:

ENTER INPUT DATA BASE NAME:

ENTER FILENAME FOR LIST OF BED IDENTIFIERS:

Example of a listing:

| BED | COUNT | MEAN    | MINIMUM         | MAXIMUM          |
|-----|-------|---------|-----------------|------------------|
| Kmw | 640   | 249.07  | 21.00 LANC0148  | 561.00 LODG0038  |
| Kcl | 649   | 241.97  | 15.00 REN00384  | 515.00 NEWC0146  |
| Kp  | 648   | 2640.52 | 285.00 LUSK0017 | 5770.00 DOUG0269 |



## OPTION 11 - REPLACE BED IDENTIS WITH DIFFERENT BED IDENTIS

This option allows a user to use a file which contains a FROM TO translation table of bed identifiers to globally change (all wells in a data base) from one or more lithologic identifier to other identifiers. The program prints the table on the printer, and after the user has confirmed the accuracy of the list, the program will read the input data base, translate all bed identifiers using the table and generate an output data base. The translation table is contained in an ASCII file that must be prepared in advance using a word processing program. We have chosen to operate from a translation table rather than from interactive input so that the changes will be documented and can be reviewed carefully.

The program will request responses to the following prompts:

ENTER FILENAME OF TRANSLATION TABLE:

REVIEW LIST OF BED REPLACEMENTS BEFORE CONTINUING  
HIT RETURN TO CONTINUE, Q TO RETURN TO MENU

ENTER INPUT DATA BASE NAME:

ENTER OUTPUT DATA BASE NAME:

ENTER TITLE FOR OUTPUT DATA BASE:

The corners of the output data base will be identical to the corners of the input data base.

EXAMPLE OF TRANSLATION TABLE:

|          |
|----------|
| Kmw, KMW |
| Kcl, KCL |
| Kp, KP   |

#### **Option 12 - CONVERT VERSION 8 GSLITH DATA BASES TO VERSION 9**

GSLITH data bases produced using the System 9 program are slightly different in format from those produced by Version 8. Option 12 provides the needed change in format. The prompts are very simple, requiring the user to enter the name of the input (Version 8) data base and the name for the output (Version 9) data base.

#### **Option 13 - CONVERT VERSION 1 GSLXY DATA BASES TO VERSION 9**

GSLITH Cartesian coordinate data bases produced using the System 9 GSLITH program are quite different in format from those produced by Version 1 of GSPXY. Option 13 provides the needed change in format. The prompts are very simple, requiring the user to enter the name of the input (Version 1) data base and the name for the output (Version 9) data base.

## GSLEDIT

GSLEDIT is designed to help edit GSLITH data bases by enabling easy selection of wells in a data base from plan views, viewing sections showing the wells on the screen, then enabling editing of elements of the data. The key to the program's operation is that it can alternate quickly between plan views, sections, and screens enabling editing of the GSLITH data base. The plot control file, projection parameter file, and unit identifier file (bed) file must be prepared before starting GSLEDIT.

The data base corners are used as the plan view corners until windowed. A section's end points are set interactively using arrow keys or a mouse. Parameters for the display of rock units are specified in the bed file. The vertical parameters for the section view are specified in a GSLEDIT plot control file prepared for the purpose of editing, and unique to each data base. This plot control contains elements common to GSLITH plot control files, but differs greatly because it must provide elements for both plan and section views. As this file is used only for plotting to the screen, pens=colors 1-15 can well be used in the unit identifier (bed) file to accentuate desired units when drawing on the screen.

### Plot control file for GSLEDIT.

File For data base "EXAMPLE", supplied with the release disk, file EXEDIT.PLT:

|                                                       |
|-------------------------------------------------------|
| 200000,200000<br>7000,12000,1000,500,.20<br>1,2,0.080 |
|-------------------------------------------------------|

XSCALE,YSCALE  
Base elev, top elev., 1000'/inch, ticks 500' apart, 0.2"=well width  
Pen=Color #1, Symbol=2, Well width=0.08"

### Cursor movement, plan view

Increments of cursor position on the monitor are quantized to pixel positions at the time of editing, as for example when entering the new position for a point that is to be moved. Enlargement on screen created by windowing is essential to much editing. Using the keyboard, the cursor can be moved either in Fast mode or Slow mode. In fast mode the cursor moves in 20 pixel increments, in slow mode, one pixel at a time. The precise positioning required for editing such as selection of a new position for a point should be done using the slow mode. The cursor is moved on the screen using the arrow keys on the numeric keypad for lateral and vertical movements, and the Home, End, PgUp and PgDn keys for diagonal movements (the Num lock must be OFF):

|                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------|
| → right<br>← left<br>↑ up<br>↓ down<br>Home=up and left<br>End=down and left<br>PgUp=up and right<br>PgDn=down and right |
|--------------------------------------------------------------------------------------------------------------------------|

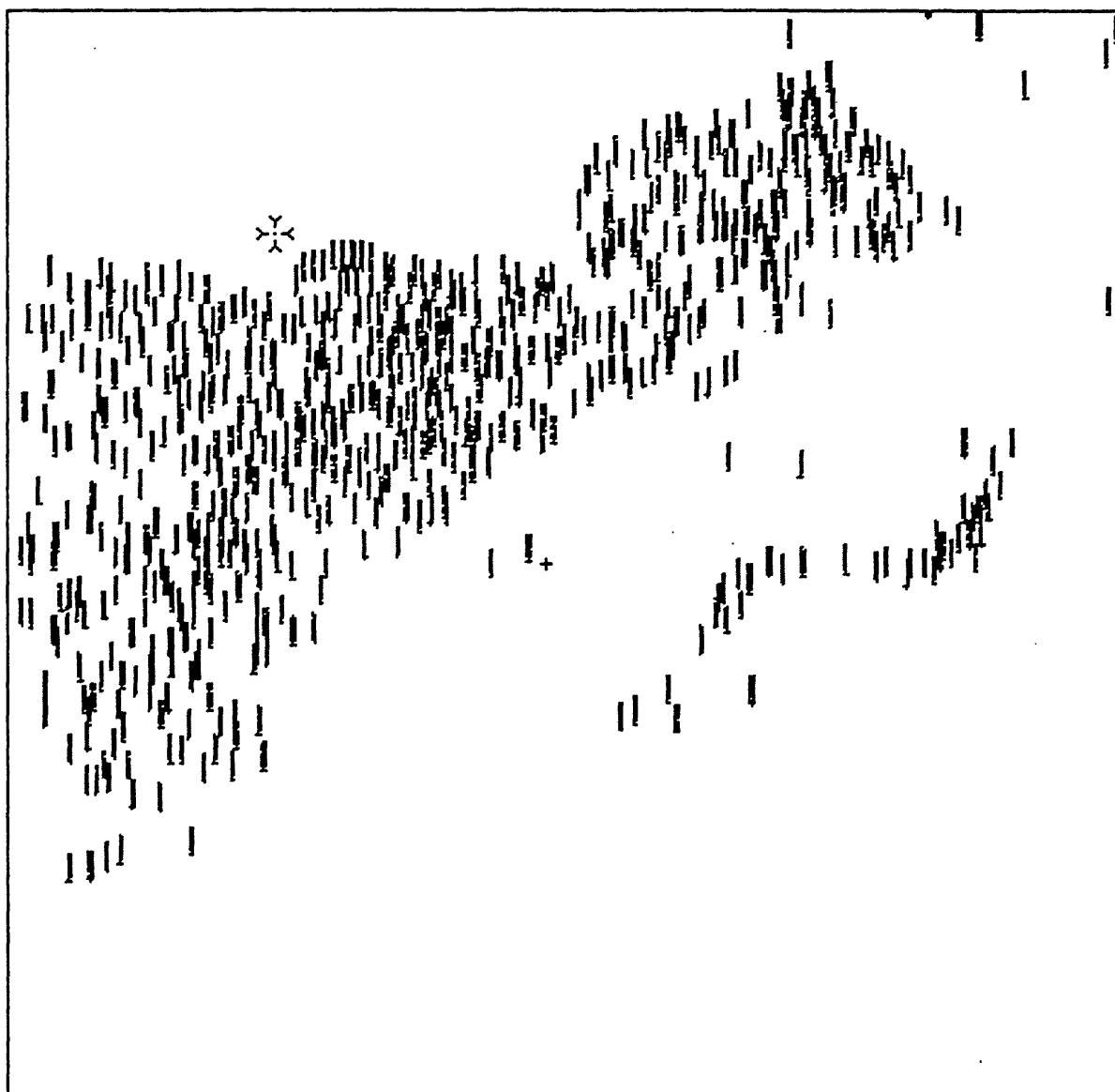
The cursor can be moved on the screen by moving a Microsoft-compatible mouse, if available, and if the mouse-driver software has been installed. A point (position) is selected by clicking the Left Button on the mouse. The mouse moves its cursor pixel by pixel.

# Sequence of screens, GSLEDIT

GSLEDIT provides the following series of screen views. The entire set of wells in the chosen area is displayed on the screen (Data base corners set the view; a portion of the area can be displayed (enlarged by windowing). A line of section can then be selected, in this case by method A graphically selecting end points. Wells within a selected distance of (here within a distance of 5 Km), highlighted on the screen, and the line of section drawn, then the wells drawn in section view (Screen #2), then the contents displayed for editing (screen

FUNCTIONS:  
A=SEL.CS.  
B=WINDOW  
C=ZOOMOUT  
D=ORG.WND  
E=REFRESH  
F=EDT.DST  
G=DRW.GRD  
H=CH.MODE  
I=SAVE.LST  
X=EXIT

1 1  
X ZM. 1  
Y ZM. 1



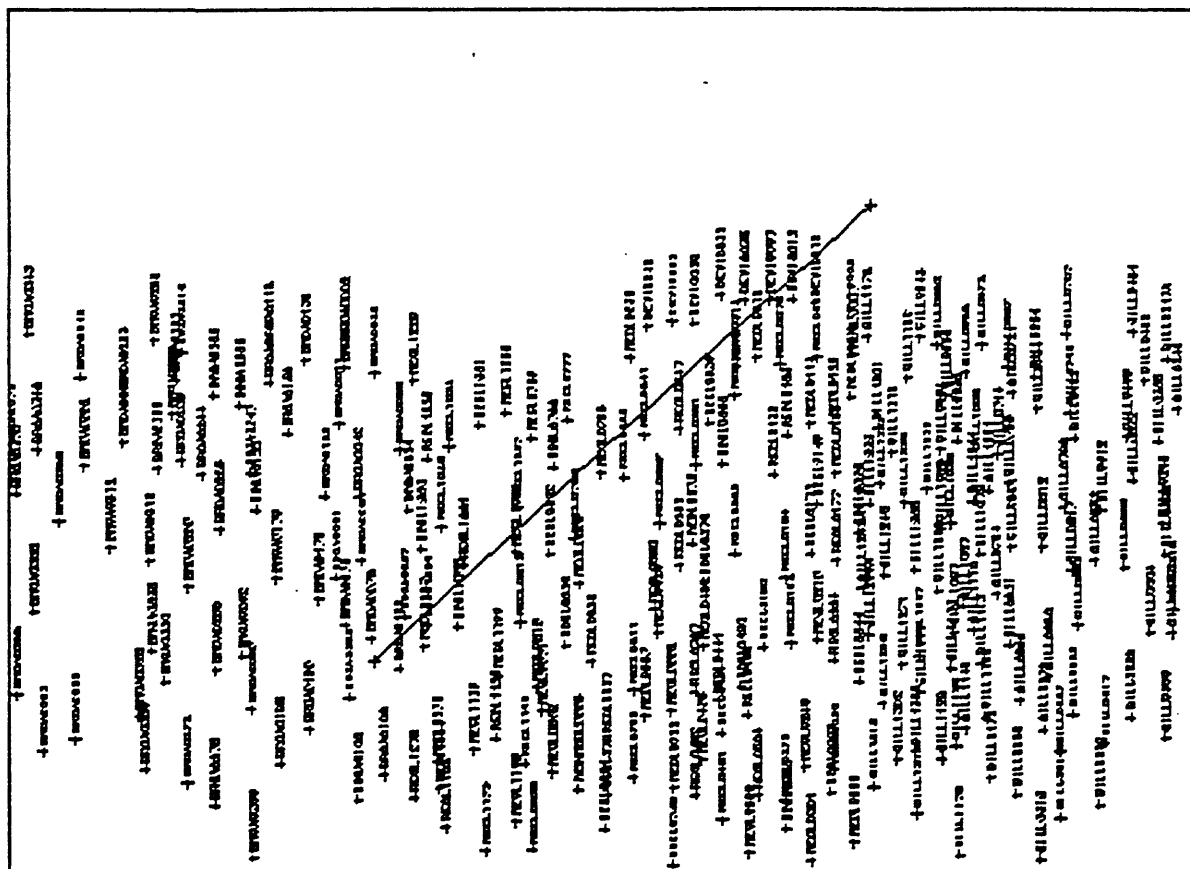
ENTER UPPER RIGHT CORNER

Screen #1, display of all wells in a data base in plan view, one corner of a window has been set, the second is indicated by the distinctive mouse cursor

FUNCTIONS  
A=2 PTS.  
B=ID.WLS  
C=RD.FILE  
D=WR.FILE  
X=EXIT

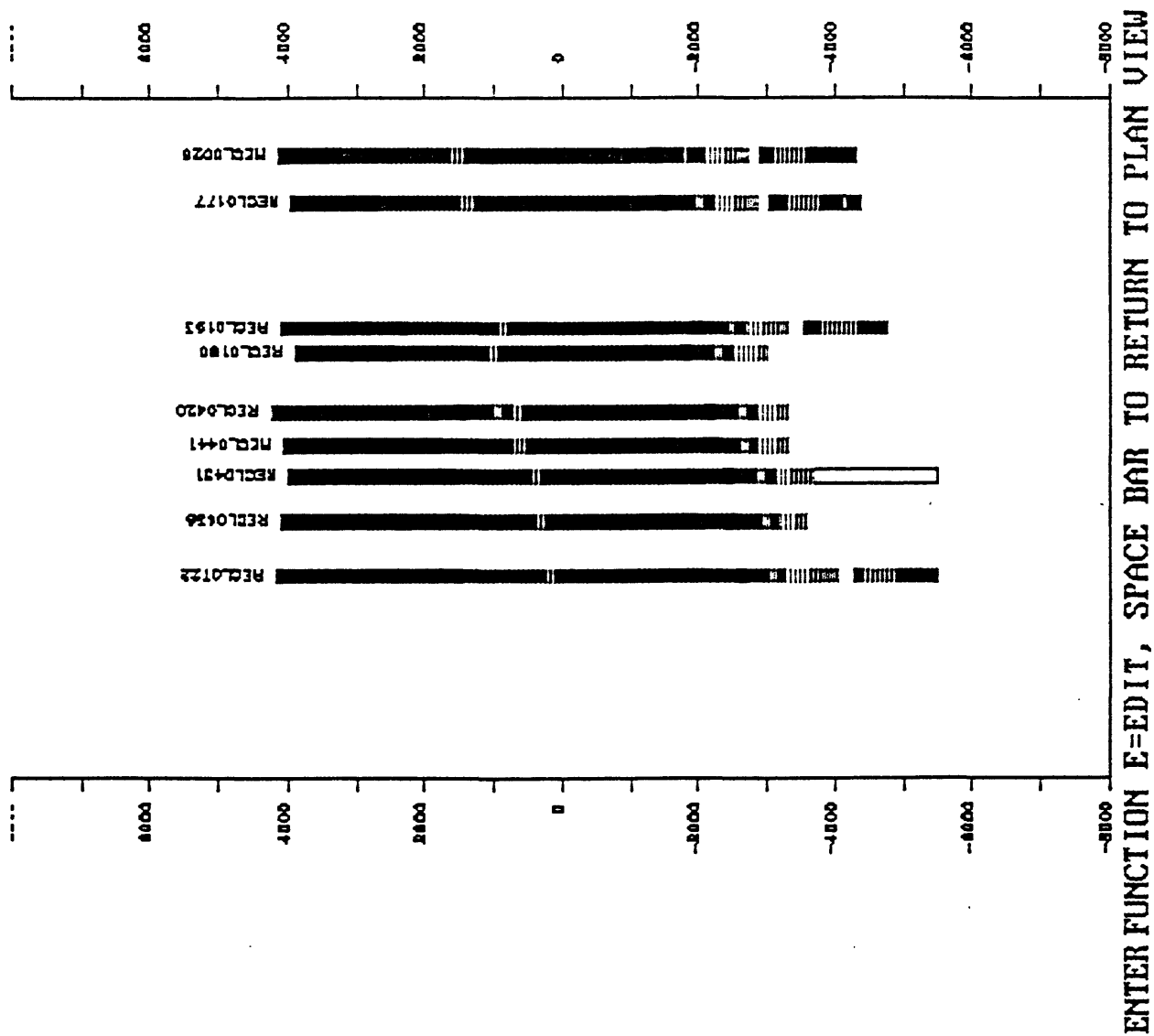
T

X ZM. 3  
Y ZM. 2



ENTER DESIRED FUNCTION USE HOT KEYS TO SELECT

Screen #1, view enlarged by windowing, the line of section has been selected.



Screen #2, section view displayed, editing selected, well to be selected using mouse cursor.

RECL0177 44 31 37.99 N 105 21 21.02 W 3959 8336 0 90 8 of 9

|    |       |        |        |        |
|----|-------|--------|--------|--------|
| 1  | T     | 0.0    | 1325.0 | 1325.0 |
| 2  | Kl    | 1325.0 | 2510.0 | 1185.0 |
| 3  | Kfh   | 2510.0 | 2700.0 | 190.0  |
| 4  | Kp    | 2700.0 | 4920.0 | 2220.0 |
| 5  | Kn    | 4920.0 | 5120.0 | 200.0  |
| 6  | Kcl   | 5120.0 | 5400.0 | 280.0  |
| 7  | Kf    | 5400.0 | 5560.0 | 160.0  |
| 8  | Kbf   | 5560.0 | 6205.0 | 645.0  |
| 9  | KbfB1 | 5860.0 | 5885.0 | 25.0   |
| 10 | KbfB2 | 5940.0 | 6000.0 | 60.0   |

NEXT WLL, PRV.WLL., CHG.BED, DEL.BED, MORE, INS.AFTER, EXIT USE HOT KEYS

RECL0177 44 31 37.99 N 105 21 21.02 W 3959 8336 0 90 8 of 9

|    |       |        |        |        |
|----|-------|--------|--------|--------|
| 1  | T     | 0.0    | 1325.0 | 1325.0 |
| 2  | Kl    | 1325.0 | 2510.0 | 1185.0 |
| 3  | Kfh   | 2510.0 | 2700.0 | 190.0  |
| 4  | Kp    | 2700.0 | 4920.0 | 2220.0 |
| 5  | Kn    | 4920.0 | 5120.0 | 200.0  |
| 6  | Kcl   | 5120.0 | 5400.0 | 280.0  |
| 7  | Kf    | 5400.0 | 5560.0 | 160.0  |
| 8  | Kbf   | 5560.0 | 6205.0 | 645.0  |
| 9  | KbfB1 | 5860.0 | 5885.0 | 25.0   |
| 10 | KbfB2 | 5940.0 | 6000.0 | 60.0   |

NEXT WLL, PRV.WLL., CHG.BED, DEL.BED, MORE, INS.AFTER, EXIT USE HOT KEYS

Screen #3, data for chosen well ready for edit.

## Operation of GSLEDIT

Enter **GSLEDIT** to start the program. After the brief display of a disclaimer screen, a series of prompts will call for responses similar to those for **GSLITH**. Enter appropriate information.

ENTER DATA BASE NAME: ?

Enter Filename for Valid Bed identifiers: ?

ENTER PLOT CONTROL FILENAME (DATABASE.PLT): ?

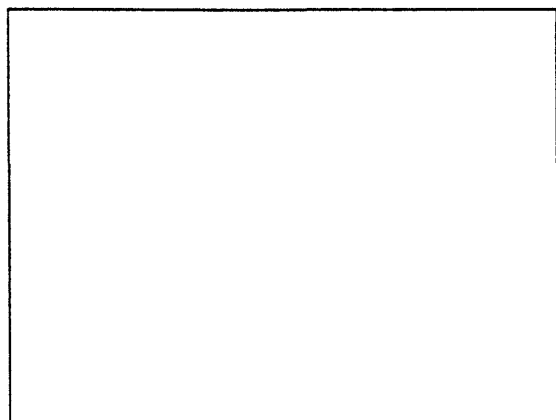
ENTER FILENAME OF PROJECTION PARAMETERS (DATABASENAME.PRJ)

MAP SIZE (X,Y) = 4.31 5.49

DO YOU WANT TO CONTINUE?(Y,n):

After confirmation of appropriate map size, needed to restrict the size of the field so that the size of arrays used by the screen graphics won't be exceeded and that scales are reasonable, the display will provide Screen #1, as below, with all wells inside the data base area plotted, and a series of hot key options (selected without use of the ENTER key to complete the entry).

### Screen #1



#### FUNCTIONS

|              |                                              |
|--------------|----------------------------------------------|
| A=SEL.CS     | Use mouse to establish end points of section |
| B=WINDOW     | Window using mouse to set corners            |
| C=ZOOMOUT    | Expand view by 25% in X and Y                |
| D=ORIG.WINDW | Return to original view, entire data base    |
| E=REFRESH    | Refresh screen                               |
| F=EDT.DST    | Change edit distance                         |
| G=DRW.GRD    | Draw a grid on the screen                    |
| H=CH.MODE    | Change mode to draw a section                |
| X=EXIT       | Exit                                         |

X ZM. 1  
Y ZM. 1

ENTER DESIRED FUNCTION

USE HOT KEYS TO SELECT

The plan view showing the wells locations using a + sign and plotting the identifiers just to the right of the symbol will be displayed inside the graphics window indicated by the box above. The first operation normally will be to select a window so that a portion of the area can be viewed in greater detail, Option B below. The next step is to select a series of wells to view in section, and edit if necessary, Option A below, then to view them in section, Option H below.

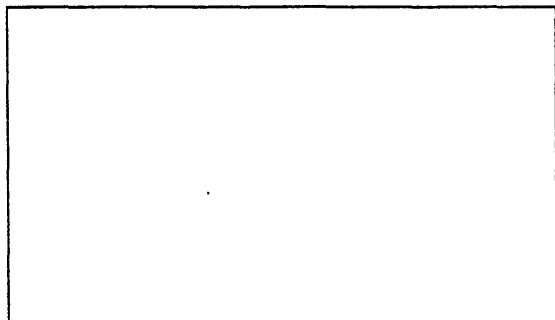
The different functions identified above have the following capabilities. After selecting one, respond to each prompt in turn.

**A=SEL.CS**

Hit A to use a mouse or the arrow keys as a pointing device to establish the end points of a cross-section to be checked using the section mode. After hitting the A key, Screen #2 will provide options:



## Screen #2



### FUNCTIONS

|               |                                              |
|---------------|----------------------------------------------|
| A=2 PTS.      | Use mouse to establish end points of section |
| B=ID.WLS      | Use mouse to select wells to be plotted      |
| C=RD.FILE     | Read an input file to select wells           |
| D=ORIG.WINDOW | Write an output file listing wells           |
| X=REFRESH     | Exit to previous screen                      |

X ZM. 1  
Y ZM. 1

ENTER DESIRED FUNCTION      USE HOT KEYS TO SELECT

Select A to choose to draw a section between two points, selecting wells within a specified distance from the line of section to be plotted.

ENTER FIRST POINT

Move the cursor to the left end of the section, enter its location.

ENTER SECOND POINT

Move the cursor to the right end of the section, enter its location.

ENTER DISTANCE (IN KMS)?

Enter the selection distance from the keyboard of the computer. Symbols and identifiers for wells within the area selected will be highlighted on the screen. The prompt line will show:

ENTER DESIRED FUNCTION      USE HOT KEYS TO SELECT

If B had been selected from screen #2, the prompts would have been:

ENTER STARTING POINT

Identify the starting point of the section; in muse-mode move the cursor to the point where the section is to start, click the left key. The next prompts will call for identification of the wells desired by moving the mouse to the well and clicking the left button; as this is done the well identified will be highlighted on the screen; the prompt will ask for confirmation that the well is correct with the C key on the keyboard.

IDENTIFY WELL

C=CONFIRM, SPACE BAR=CONTINUE SEARCH, X=EXIT

After all desired wells have been identified click the right mouse button to bring the prompt:

ENTER ENDING POINT

Move the mouse to the desired position, click the left mouse key to identify the point. The prompt will change to:

ENTER DESIRED FUNCTION      USE HOT KEYS TO SELECT

**C=RD.FILE**

ENTER FILENAME OF INPUT FILE

**This file contains data on the wells to be shown in section, and their spacing, as below:**

|       |             |        |            |
|-------|-------------|--------|------------|
| 1     |             |        |            |
| 38 54 | 27.04500 N, | 105 44 | 30.69700 W |
| 38 54 | 37.24700 N, | 105 31 | 18.41800 W |
| "T1   | "           |        | 0.4493     |
| "T2   | "           |        | 1.9657     |
| "T3   | "           |        | 3.0396     |
| "     | "           |        | 3.7569     |

**D=WR.FILE**

ENTER FILENAME OF OUTPUT FILE

The format for the output file is the same as that for the input file above.

After selecting a section for examination, choose X from screen #2 to return to Screen #1 for display of the cross section and editing.

**B=WINDOW**

Choose B from screen #1 to set a window providing a closer view of a part of the data base, using a mouse or the arrow keys as a pointing device to establish the SW and NE corners of the window. Prompts: ENTER LOWER LEFT CORNER

ENTER UPPER RIGHT CORNER

**C=ZOOMOUT**

**Choose C from screen #1 to expand the view on the screen by 25% in X and Y.**

**D=ORIG.WINDW**

**Choose D from screen #1 to return to the original view of the entire data base.**

**E= REFRESH**

**Choose E from screen #1 to refresh the screen.**

**F=EDT DST**

Choose F from screen #1 to change the edit distance. The prompt supplies the default value of 0.1", change the edit distance if problems are encountered in identifying wells:  
ENTER EDIT DISTANCE (0.1): ?

**G=DRW,GRD**

Choose G from screen #1 to draw a grid (+ symbols) on the screen to assist locating coordinate positions. The prompt is:  
ENTER DELTA(DD,MM,SS): ?

The response is in degrees, minutes, seconds, e.g. 0.2.30.

## **H=CH.MODE**

Choose **H** from screen #1 to change the program's mode to view a section on the screen displaying the wells selected from the plan view. Parameters for a section must be identified ( options **A** or **B** from screen #2) before choosing option **H**. The section will be drawn on the screen displaying wells selected and end lines with elevations posted to left and right. The well's identifiers will be plotted above each well. The prompt will read:

**ENTER FUNCTION E=EDIT, ANY OTHER KEY TO RETURN TO PLAN VIEW**

Hit any key to return to screen #1. or hit **E** key to view data for the well's selected, beginning with the well plotted at the left side of the section. A cursor will be present on the screen; if in keyboard mode, it will be a small + located near the lower left corner of the screen. If you wish to choose a particular well to view and edit records, move the cursor to the well and hit the **ENTER** key. In mouse-mode the cursor will have it's distinctive shape (see cover); to select a well for edit, move the cursor to the well and click the left mouse key.

### **E to Edit well records**

After hitting the **E** key and moving to screen #3 the prompt at the base of the screen will be:  
**NEXT WLL, PREV WLL., CHG BED, DEL. BED, MORE, INS AFTER, EXIT USE HOT KEYS**

**N** changes editing to the next well to the right along the chosen section.

**P** moves to the well to the left (previous well).

**C** starts the sequence for changing parameters for a bed yet to be specified.

**M** displays the next 10 records for a well with too many beds to fit on a single screen.

**I** allows insertion of a bed record in a well (below a record to be specified).

**X** Edit the file as desired, much as in Option 7 of **GSLITH**. Hit **X** to **EXIT** to screen #1.

## **EXIT GSLEDIT**

Choose **X** from screen #1 to end the current session in **GSLEDIT**, either to change to another data base, or to exit to **DOS**.

105° 45' 0" W  
+

105° 30' 0"W  
+ 39° 0' 0" N



LINE OF SECTION



+ 38° 45' 0" N  
105° 30' 0"W

Figure 34. Plan view for tutorial exercise. Drill holes with identifiers and line (dotted) of section have been drawn, map corners shown by + symbols.

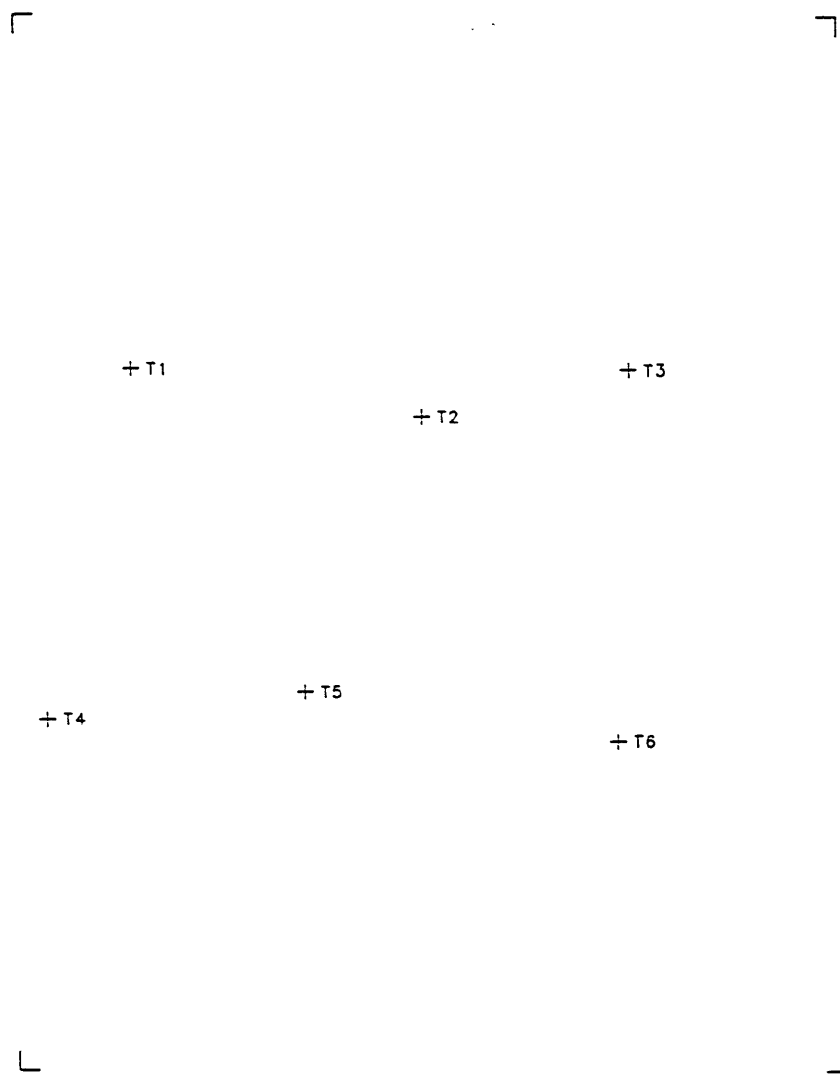


Figure 35. GSLITH plan view, tutorial exercise. Well identifiers have been plotted. GSLITH plot file PLAN1.PLT.

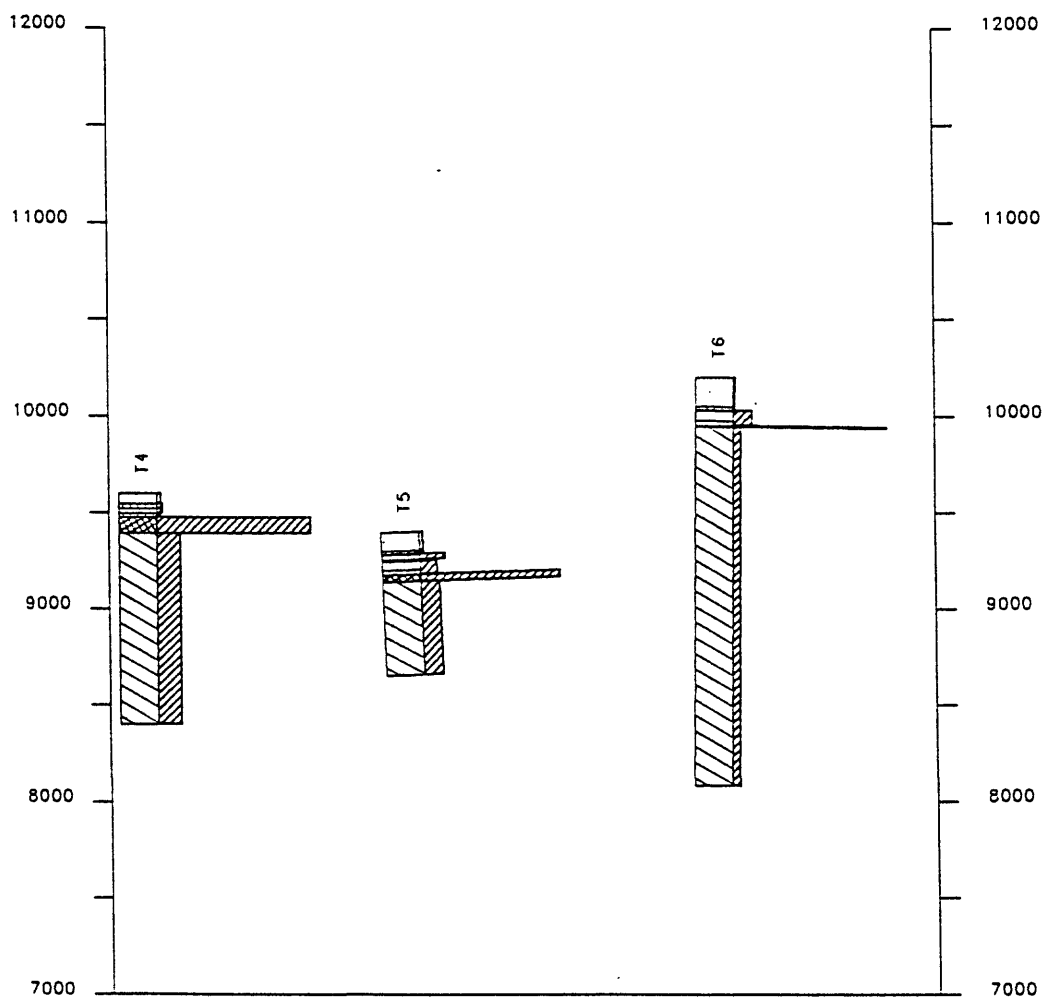


Figure 36. Example of cross section with numeric variables plotted as a bar graph attached to the lithologic log. GSLITH plot file SECT1.PLT, numeric variable file HIST.VAR.

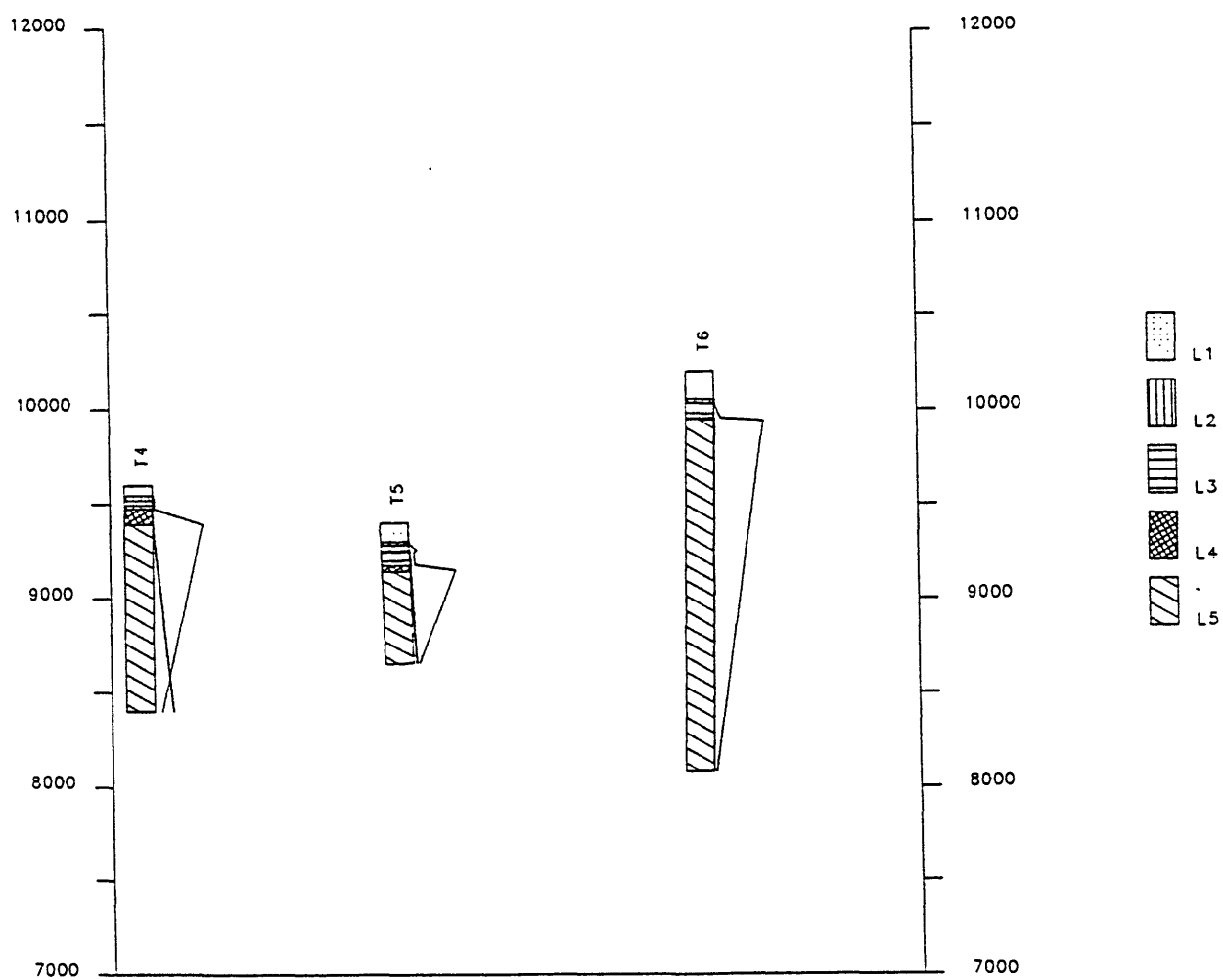


Figure 37. Section with numeric variables plotted as a trace on the right side of the lithologic log. GSLITH plot file SECT2.Plt, numeric variable file TRACE.VAR, legend plotted.

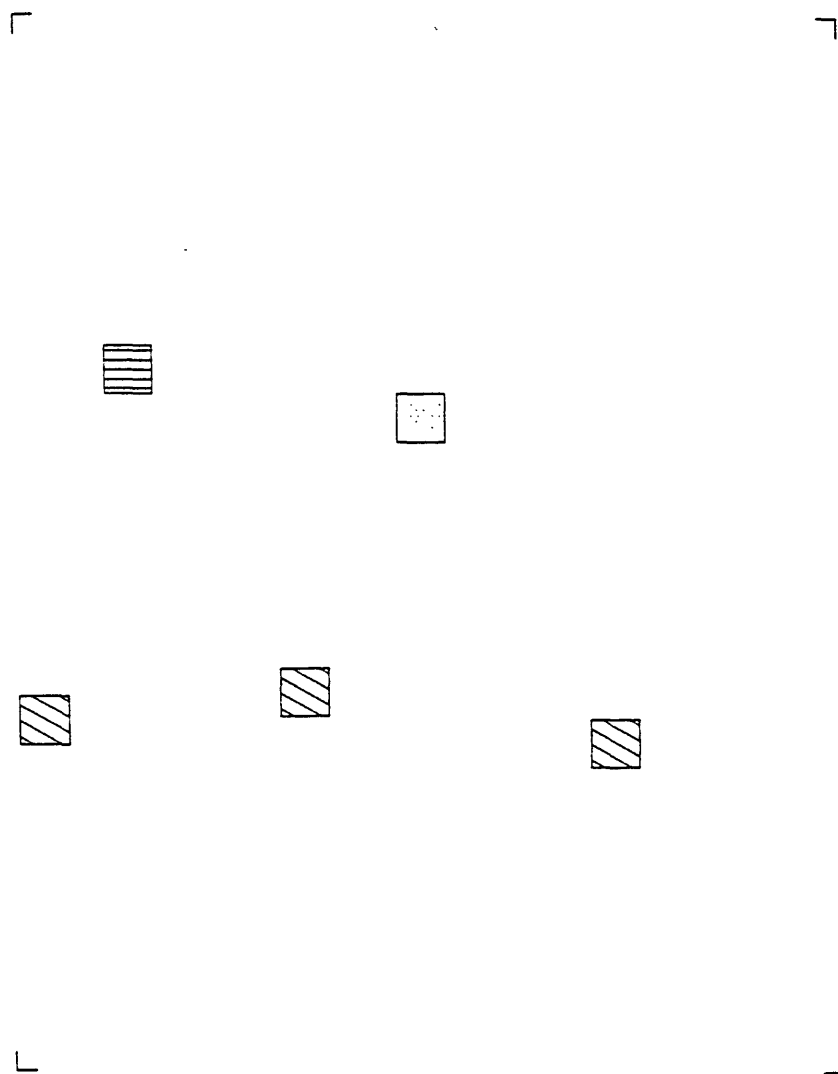


Figure 38. Plan view, type 11. Units plotted at an elevation of 9000 feet. GSLITH plot file Plan2.PLT.



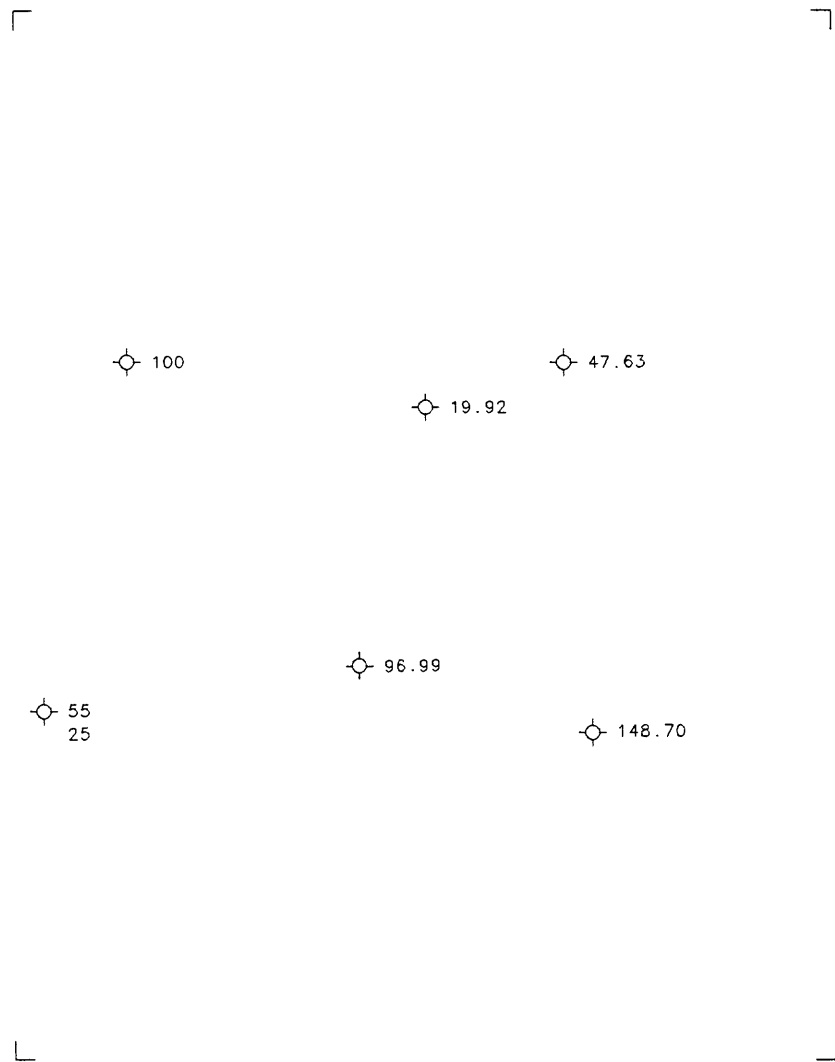


Figure 39 Plan view type 7. Locations of drill holes, with thickness(s) of unit L1 plotted. GSLITH plot File PLAN3.PLT.

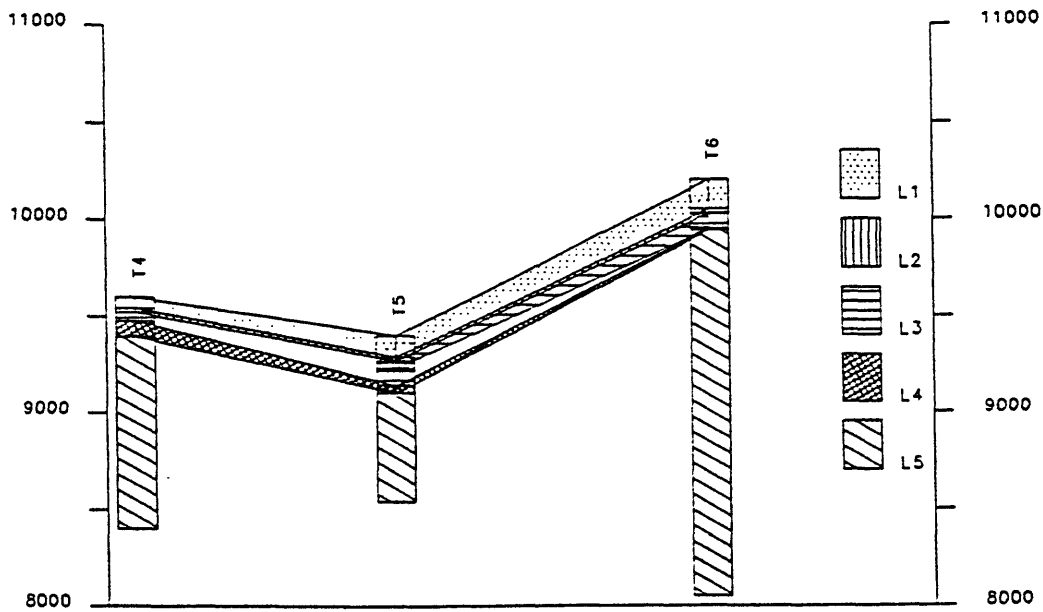
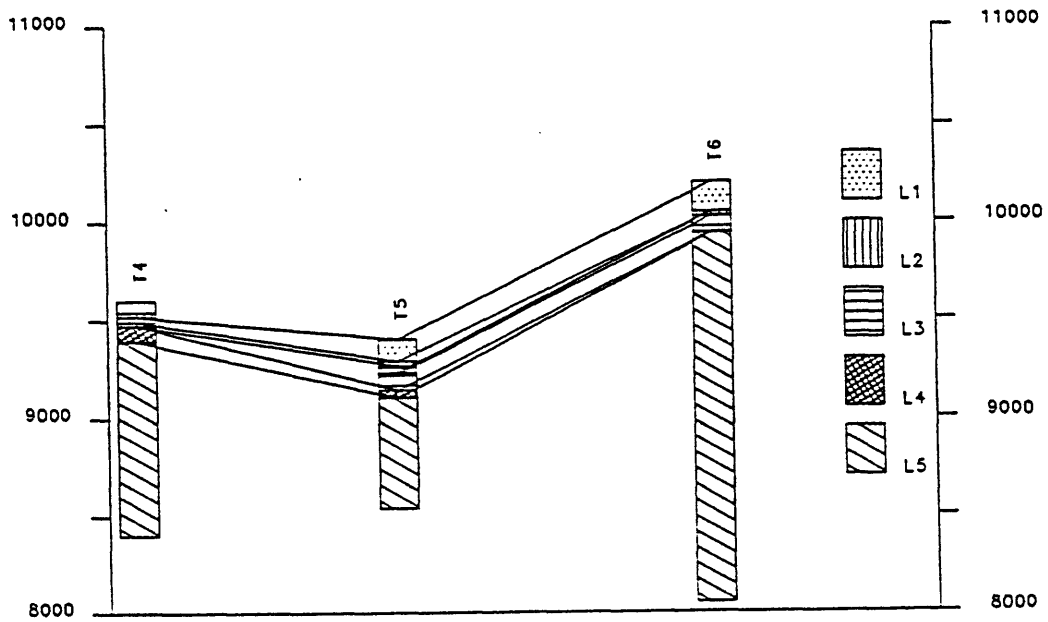


Figure 40. Sections drawn using Special Section Option 10; upper section connects units using Lines, lower section connects units using fill patterns.GSLITH plot file SECT4.PLT.

## JUMPSTART GSLITH

We suggest starting with GSLITH by doing a small "hands on" exercise. The exercise includes digitizing, data entry, and plotting of sections and plan views. We assume the availability of hardware, properly configured. Perhaps a system configured for GSMAP.

First turn all of the hardware on: plotter, digitizer, printer, monitor and computer. If units are separately switched, boot up the computer last. Check to see that the files listed below are available on the default drive. They are included with this release.

We assume now that all hardware is operative and properly connected. The first four files are necessary to the operation of GSLITH; the other files (labeled with an asterisk in the list below) are specific to the exercise described in this section.

|                |                                                                      |
|----------------|----------------------------------------------------------------------|
| CONFIG9.SCR    | File specifies the graphics system.                                  |
| CONFIG9.DIG    | File specifies digitizer configuration and communication parameters. |
| CONFIG9.PLT    | File specifies plotter configuration and communication parameters.   |
| CONFIG9.SYM    | File provides definitions of symbols.                                |
| GSLITH.EXE     | File is the GSLITH program.                                          |
| O.FNT          | File provides definitions of alphanumeric characters.                |
|                |                                                                      |
| *DRILL.BED ... | This is the unit identifier file for this exercise.                  |
| *PLAN1.PLT ..  | Example of plan view plot control file type 1.                       |
| *PLAN2.PLT ..  | Example of plan view plot control file, type 11.                     |
| *PLAN3.PLT ..  | Example of plan view plot control file, type 7                       |
| *SECT1.PLT ..  | Example of cross section plot control file, type 1.                  |
| *SECT2.PLT ..  | Example of cross section plot control file, type 2.                  |
| *SECT3.PLT ..  | Example of cross section plot control file, type 3.                  |
| *SECT4.PLT     | Example of cross section plot control file, type 4.                  |
| *SECT1.ASC ..  | Example of data file used with SECT3.PLT.                            |
| *TRACE.VAR ..  | Example of a "trace" file used for plotting numeric variables.       |
| *HIST.VAR ...  | Example of a "hist" file used for plotting numeric variables.        |
| *LABEL.VAR...  | Example of a "label" file used for plotting numeric variables.       |
| *EXAMPLE.NDX   | Index file for data base EXAMPLE                                     |
| *EXAMPLE.LSF   | Data file for data base EXAMPLE                                      |

In addition to these files from the release disk, an ASCII text editing processing program should be available.

## THE UNIT IDENTIFIER FILE

The file which contains identifying names and graphic patterns for each unit that will be distinguished in the well records is called the UNIT IDENTIFIER FILE, or may be requested as the file containing VALID BED IDENTIFIERS.

The example of the unit identifier file printed below is DRILL.BED. Its six columns contain the data needed by the GSLITH program for data entry and for definition of the patterns used to represent rock units in the drawings produced by the program. Each record (line in the file) contains information for one unit. This file is used in the tutorial exercise.

| FILE                  | CONTENTS                                                  |
|-----------------------|-----------------------------------------------------------|
| L1, 1, 1, 1, .03, 0   | Unit=L1, Pen#=1, Line type=1, Fill=1, Spacing=0.03", 0°   |
| L2, 1, 0, 1, .04, 90  | Unit=L2, Pen#=1, Line type=1, Fill=1, Spacing=0.04", 90°  |
| L3, 1, 0, 1, .05, 0   | Unit=L3, Pen#=1, Line type=0, Fill=1, Spacing=0.05", 0°   |
| L4, 1, 0, 2, .03, 30  | Unit=L4, Pen#=1, Line type=0, Fill=2, Spacing=0.03", 30°  |
| L5, 1, 0, 1, .07, -30 | Unit=L5, Pen#=1, Line type=0, Fill=1, Spacing=0.07", -30° |

Each record (line) of the unit identifier file contains the following data for one lithologic unit:

Unit identifier, pen number, line type, fill type, spacing between lines in inches, angle from horizontal in degrees (+ = counterclockwise). A carriage return is required at the end of each line in the file.

All projects start by creating a unit identifier file using a word processing program. We assume that you know how to create an ASCII file, so to speed things along we suggest using the file DRILL.BED included on the release disk.

When you create such ASCII files, be sure that your word processing program doesn't leave non-printing embedded characters.

The map needed for this project is included here as Fig. 35. Symbols on this map indicate the locations of six drill holes. A location identifier (eg. T2) plotted near each symbol provides the identifier (ID) of the well. The four corners of the map are shown by + symbols. The latitude and longitude of the corners are posted near the corners.

## Using GSLITH to start a data base

Start the tutorial exercise by entering **GSLITH** from the keyboard. The files listed on p. 296 should be available to you.

After a brief display of the disclaimer the Main Menu will appear on the screen. Begin by entering **1** to start a new data base (type **1**, then hit the enter key). Screen prompts will direct you to make a series of entries:

ENTER DATA BASE NAME:

We used "EXAMPLE", so please use a different name. The name **EXERCISE** might be used: The name you use is used for data base files generated by GSLITH and must follow the DOS convention for the name of a file; the proper extensions are added by the program.

ENTER MAP TITLE (36 CHARACTERS):

The title "Tutorial" might be used. A message will be displayed next:

### TYPES OF MAPS

- 1 - 7 1/2 MINUTE
- 2 - 15 MINUTE
- 3 - 30 MIN LAT x 1 DEG LONG
- 4 - 1 DEG LAT x 2 DEG LONG
- 5 - OTHER

ENTER TYPE:

Enter **2**

The next prompt asks for entry of the coordinates of the northwest corner of the map.

ENTER LATITUDE, LONGITUDE OF NW CORNER  
DD,MM,SS,C,DDD,MM,SS,C

Enter the coordinates in the format requested. Enter **39,0,0,N,105,45,0,W**

The next prompts will ask for the number of numeric variables: Enter **2**.

The next prompt will ask for the file name for valid bed identifiers:

ENTER FILENAME FOR VALID BED IDENTIFIERS: ?

Enter **DRILL.BED**. This entry will return the screen to the Main Menu.

## Digitizing locations of wells

The next step is to digitize the locations of drill holes. Option 3 specified from the Main Menu is used when digitizing these locations. When a location is digitized a record is started for that well.

Tape Figure 35 securely to the digitizer table within the active area of the digitizer. The map must not move during digitizing. Select option 3 DIGITIZE NEW WELL LOCATIONS by entering 3 from the Main Menu screen.

The screen will prompt:

ENTER FILENAME OF PROJECTION PARAMETERS: ?

Enter **EXAMPLE.PRJ**. We will use the UTM defined by this file for this exercise. The next prompt will be:

ARE THE DATA BASE CORNERS THE CORNERS OF THIS MAP?(Y/N): ?

Enter **Y**. The next prompts establish a "mask" to enable use of alpha characters at the start and end of the well identifier. The prompts are as below.

FOLLOWING QUESTIONS APPLY TO WELL ID MASK(MAX OF 12 CHARS (TOTAL)

ENTER PREFIX: ?

Enter **T**

MAXIMUM NO OF DIGITS: ?

Enter **1**

ENTER SUFFIX

Press the **ENTER** key to specify that no suffix is wanted.

The next prompt will start a sequence of entries from the keypad of the digitizer.

ENTER 0 (ZERO) KEY ON CURSOR KEYPAD TO SYNCHRONIZE DIGITIZER INPUT

For this entry from the digitizer the position of the cursor (within the active area of the digitizer) is not important. Press the zero key on the keypad of the digitizer. The next part of the digitizing procedure indexes the map to the digitizer table using the map corners. Follow the directions provided by the screen prompts as they appear:

ENTER NORTHWEST CORNER ON DIGITIZER

ENTER SOUTHWEST CORNER ON DIGITIZER

ENTER SOUTHEAST CORNER ON DIGITIZER

ENTER NORTHEAST CORNER ON DIGITIZER

These entries are made by pressing the zero key on the cursor keypad with the cross hair of the cursor precisely positioned on the map at the position called for. These entries complete the indexing of the map to the digitizer table. After entering the fourth corner a prompt will be displayed on the screen.

X SCALE = 200,322. Y SCALE = 201,244 (or similar numbers)  
CONTINUE (Y/N) ?

If there is a problem in indexing the corners, you may get a message: SCALE DIFFERS BY MORE THAN 2%, CONTINUE (Y/N?). This message always indicates some sort of problem. If digitizing real data points, digitizing should not continue (answer N). If you are working with a copy of this documentation copied too many times you may get this message. For purposes of this exercise, please proceed.

If all is well enter Y from the keyboard so that digitizing can continue. A prompt will appear:  
ENTER WELL ID:

Choose a well to digitize. Using the keypad of the cursor, enter the number of the well on the keypad of the digitizer, e.g. 1. After entry the computer will sound an audible tone and the identifier will be shown on the screen followed by a prompt:  
ENTER LOCATION ON DIGITIZER:

Accurately position the cross hair of the cursor at the location of the well being digitized, and depress the 1 key to record this location. After this has been done, the system is ready to accept the number for another well from the keypad, the prompt ENTER WELL IDENT: will again be displayed. Continue the procedure as described to enter the next well number, then digitize the location of this well. Continue until all wells have been entered and their locations have been digitized.

To end the digitizing session press the C key on the keypad instead of entering a well number.

Three prompts requesting entry of prefix, then the number of digits, and last the suffix will be provided on the lowest line of the screen. Press the ENTER key on the keyboard of the computer as the response to each of these prompts. These entries will return operations to the Main Menu screen. Additional wells can be digitized at a later time if desired and thus added to the data base if you choose to enlarge the data base.

The next step in this exercise is to enter data on the units encountered in the drill holes, and the numeric values that apply to those units.

## Entering well data

Select option 6 by entering 6 from the Main Menu to begin the process of entering data for the wells for this project. The screen will display the following prompt:  
ENTER WELL IDENT (cr to EXIT): ?

Enter **T1** to select well T1 for data entry. Unlike some operations under the DOS system, T1 and t1 are not equivalent. Case sensitivity (the distinction between upper case and lower case letters) is honored for well identifiers and for lithologic identifiers. At this point the screen should show:  
ENTER WELL IDENT(cr TO EXIT): T1  
THERE ARE 0 BED RECORDS CURRENTLY  
ENTER TOP ELEVATION

The next following two pages provide data for the drill holes in this exercise. In this listing "Well#" is used for the well identifier, and "Unit" for bed identifier. The depths to the top and bottom of each unit are provided in separate columns.

During data entry follow directions provided by the screen prompts. When all data for a well has been entered hit the enter key instead of entering a bed identifier, and the next prompt will request entry of another Well IDENT; enter another WELL IDENT and proceed until all data is entered. The example below shows the appearance of the screen early in the process of data entry:

```
ENTER WELL IDENT(cr TO EXIT): ? T1
THERE ARE 0 BED RECORDS CURRENTLY
ENTER TOP ELEVATION: ? 9200
ENTER TOTAL DEPTH: ? 901
ENTER BEARING: ? 0
ENTER PLUNGE: ? 90
ENTER BED IDENTIFIER: ? L1
ENTER DEPTH TO TOP: (0) ?
ENTER DEPTH TO BOTTOM (100) ?
ENTER NUMERIC VARIABLES (N,N): 1,1
ENTER BED IDENTIFIER: ? ?
```

Enter data for lithologic units starting with the uppermost unit and ending with the lowest unit. After entering data for the uppermost lithologic unit if the depth to the top of the next unit (down) is the same as the depth to the bottom of the overlying unit, hit the ENTER key and this value will be entered as the default value. As shown above, numeric variables are entered by typing the number, then a comma, then the next numeric variable for the unit, then pressing the enter key to record the values. At some point, you may want to try to enter an incorrect unit name (other than the L1, L2, L3, L4, and L5 defined in the unit identifier file DRILL.BED). The program will check, then call for a correct bed identifier without allowing entry of the incorrect record. The prompt INVALID BED IDENTIFIER - REENTER will be shown.

When all lithologic data has been entered for a well hit the ENTER key instead of specifying a lithologic identifier at the prompt:  
ENTER BED IDENTIFIER: ?

This will bring the prompt:  
ENTER WELL IDENT (cr to EXIT): ?

Follow the prompts. Continue entering data in this way until data for all wells has been entered. When you have entered data for all wells, or are tired of the exercise, hit the ENTER key at the prompt:  
ENTER WELL IDENT (cr to EXIT): ? This returns operations to the Main Menu.



# Data for tutorial exercise

| Well#             | Elev. | Depth  | Bearing | Plunge |
|-------------------|-------|--------|---------|--------|
| T1                | 9200  | 901    | 0       | 90     |
| Numeric Variables |       |        |         |        |
| Unit              | Top   | Bottom | #1      | #2     |
| L1                | 0     | 100    | 1       | 1      |
| L2                | 100   | 193    | 3       | 0      |
| L3                | 193   | 305    | 2       | 1      |
| L4                | 305   | 411    | 80      | 1      |
| L5                | 411   | 901    | 22      | 18     |

| Well#             | Elev. | Depth  | Bearing | Plunge |
|-------------------|-------|--------|---------|--------|
| T2                | 9000  | 752    | 78      | 85     |
| Numeric Variables |       |        |         |        |
| Unit              | Top   | Bottom | #1      | #2     |
| L1                | 0     | 20     | 1       | 0      |
| L2                | 20    | 135    | 3       | 0      |
| L3                | 135   | 156    | 7       | 1      |
| L4                | 156   | 200    | 62      | 3      |
| L5                | 200   | 752    | 14      | 6      |

| Well#             | Elev. | Depth  | Bearing | Plunge |
|-------------------|-------|--------|---------|--------|
| T3                | 8800  | 540    | 270     | 60     |
| Numeric Variables |       |        |         |        |
| Unit              | Top   | Bottom | #1      | #2     |
| L1                | 0     | 55     | 4       | 0      |
| L4                | 55    | 75     | 80      | 1      |
| L5                | 75    | 540    | 12      | 40     |

| Well#             | Elev. | Depth  | Bearing | Plunge |
|-------------------|-------|--------|---------|--------|
| T4                | 9600  | 1020   | 0       | 90     |
| Numeric Variables |       |        |         |        |
| Unit              | Top   | Bottom | #1      | #2     |
| L1                | 0     | 55     | 2       | 0      |
| L2                | 55    | 80     | 3       | 0      |
| L1                | 80    | 105    | 3       | 2      |
| L2                | 105   | 125    | 2       | 0      |
| L4                | 125   | 207    | 78      | 1      |
| L5                | 207   | 1020   | 12      | 20     |

| Well#             | Elev. | Depth  | Bearing | Plunge |
|-------------------|-------|--------|---------|--------|
| T5                | 9400  | 860    | 75      | 60     |
| Numeric Variables |       |        |         |        |
| Unit              | Top   | Bottom | #1      | #2     |
| L1                | 0     | 112    | 2       | 1      |
| L2                | 112   | 132    | 2       | 0      |
| L3                | 132   | 167    | 13      | 1      |
| L2                | 167   | 179    | 1       | 1      |
| L3                | 179   | 258    | 9       | 2      |
| L4                | 258   | 298    | 72      | 2      |
| L5                | 298   | 860    | 10      | 4      |

| Well#             | Elev. | Depth  | Bearing | Plunge |
|-------------------|-------|--------|---------|--------|
| T6                | 10200 | 2150   | 270     | 80     |
| Numeric Variables |       |        |         |        |
| Unit              | Top   | Bottom | #1      | #2     |
| L1                | 0     | 151    | 1       | 1      |
| L2                | 151   | 172    | 1       | 0      |
| L3                | 172   | 252    | 10      | 0      |
| L4                | 252   | 260    | 80      | 1      |
| L5                | 260   | 2150   | 4       | 0      |

## Plotting

GSLITH requires user-created files to control the drawing of cross sections and plan views. Cross sections are drawn using Options 9 or 10 selected from the Main Menu; plan views are drawn using Option 11.

Plan view with drill hole IDs posted, Fig. 35. This plan is drawn using the plot control file PLAN1.PLT printed below.

| <u>File</u>            | <u>PLAN1.PLT</u> | <u>Comments (not a part of the file)</u>       |
|------------------------|------------------|------------------------------------------------|
| 1                      |                  | Plan view type 1 (locations, with identifiers) |
| 39,00,00,N,105,45,0,W  |                  | Lat, Long of NW corner of plot area            |
| 38,45,0,N,105,45,0,W   |                  | Lat, Long of SW corner of plot area            |
| 38,45,0,N,105,30,00,W  |                  | Lat, Long of SE corner of plot area            |
| 39,00,00,N,105,30,00,W |                  | Lat, Long of NE corner of plot area            |
| 200000,200000          |                  | Xscale=200000, Yscale=200000                   |
| 1,2                    |                  | XOFFSET=1", YOFFSET=2"                         |
| Y                      |                  | Yes rotate on plotter                          |
| 12,2                   |                  | Speed=12 cm/sec, Force=2                       |
| 0.1,0.15               |                  | Width=0.1", Height=0.15" of label characters   |
| "NOSTRAT",,0           |                  | Record required for labeling                   |
| 1,9,80                 |                  | Pen=1, Symbol=9, Size=80/1000"                 |

Now, plot figure 35 using this plot control file. Load the plotter with paper and check to see that pens are ready. You might use a fine black pen in position #1, fine red in #2, fine blue in #3. Select option 11 from the Main Menu by entering 10.

The program will supply a series of prompts: answer each in turn as shown below in bold type.

**ENTER FILENAME OF PROJECTION PARAMETERS (DATABASENAME.PRJ)?**

Enter **EXAMPLE.PRJ**

**SCREEN PLOTTER DISK? (S,p,d):?**

Enter **P**. The screen will prompt:  
**ENTER PLOT CONTROL FILENAME:**

Enter **PLAN1.PLT**. After this entry a message will provide the size of the map in inches.

**MAP SIZE(X,Y) 5.31 7.49**

**DO YOU WANT TO CONTINUE?(Y/N):**

Enter **Y**. The next prompt will be:  
**DO YOU WANT TO CREATE AN ASCII FILE X,Y,Z?(y/N)**

Enter **N** or hit the **ENTER** key (the default answer in N).

The screen will prompt:  
**PLOTTER SHOULD BE TURNED ON AND PAPER LOADED**  
**HIT ANY KEY WHEN READY**

Hit the space bar, and the plotter will then draw figure 2. After plotting, two prompts will request entries:

DO YOU WANT TO DRAW CORNER BRACES?(Y/N): ?

ENTER Y

DO YOU WANT INTERNAL TICK MARKS?(Y/N ?

ENTER N

After this entry the system will return to the Main Menu. The plot should be ready for your inspection.

Cross section view, Fig. 36. This section is drawn along the east-west line 38°50'0" latitude, see Fig. 37 for trace. SECT1.PLT is the plot control file used to draw this cross section. Let's draw this one on the screen.

| <u>File</u>             | <u>SECT1.PLT</u> | <u>Comments (not a part of the file)</u>                                               |
|-------------------------|------------------|----------------------------------------------------------------------------------------|
| 1                       |                  | Section type=1                                                                         |
| 7000,12000,1000,500,.20 |                  | Base elev.=7000',top elev.=12000',vert scale=1000'/inch, tick interval=500',width 0.2" |
| 200000                  |                  | Horizontal scale 1:200000                                                              |
| 1,2                     |                  | XOFFSET=1", YOFFSET=2"                                                                 |
| Y                       |                  | Yes rotate on plotter                                                                  |
| 12,2                    |                  | Speed=12 cm/sec, Force=2                                                               |
| 0.04,0.06               |                  | Width=0.04", Height=0.06 for label characters                                          |
| "NOSTRAT",,0            |                  | Plot at true elevation                                                                 |
| N,0,0                   |                  | No don't plot legend                                                                   |
| 38,50,0,N,105,45,0,W    |                  | Lat, Long coordinates of left end of section                                           |
| 38,50,0,N,105,30,0,W    |                  | Lat, Long coordinates of right end of section                                          |
| 10000                   |                  | 10000' (plot wells within 10000' of section line                                       |

Select option 9 from the Main Menu. Enter 9

Prompts will request entries; answer each prompt in turn as indicated below.

ENTER FILENAME OF PROJECTION PARAMETERS (DATABASENAME.PRJ)?

Enter **EXAMPLE.PRJ**

SCREEN,PLOTTER,DISK? (S,p,d)

Hit the ENTER key to select the screen (default value shown by uppercase letter).

DO YOU WANT TO PLOT THE NUMERIC VARIABLES:?(Y N): ?

Enter Y

ENTER PLOT CONTROL FILE FOR NUMERIC TRACE: ?

Enter **HIST.VAR**

ENTER PLOT CONTROL FILENAME: ?

Enter **SECT1.PLT**

CREATE AN ASCII FILE CONTAINING WELL #, DISTANCE DOWN SECTION?(y/N): ?

Enter N

After this entry the section will be drawn on the screen....

## Check out GSLEDIT

We suggest that you try the GSLEDIT program. It is an excellent way both to view and edit the contents of a data base. Use the EXEDIT.PLT plot file with the data base EXAMPLE, UNIT IDENTIFIER file EXAMPLE.BED, and EXAMPLE.PRJ; these files are supplied to you on the release diskette. Follow the prompts; most will be completely familiar to you. In particular, try each of the three parts of this program; first the plan view, then after selecting a line of section (Option A, screen #1, then Option A screen #2, then using Option X go back to screen #1, try Option H, to view the wells in section. Then select E to edit a record.

## Review of tutorial

The file that identifies standard units and specifies graphical plot patterns for these units must be prepared before starting GSLITH. This unit identifier file or bed file is utilized by the program to check the well data as they are entered to verify consistency of the unit identifiers during entry. This insures that a standard terminology is used, that all identifiers have been specified, and that graphical patterns are defined for all lithologic units. Similar files are used to control plots of the numeric variables. These must be available when using Option 9 if you wish to plot the variables.

When starting a new project, Option 1 from the Main Menu is used to create a database. The latitude and longitude coordinates of the corners specified for the database should match the corners of the map that will be used for digitizing well locations.

Next, one uses Option 3 from the main GSLITH Menu to enter the well identifiers and to digitize the well locations from the map.

Then, using option 6 from the Main Menu, data for the lithologic units in each well log is entered into the data base.

At this point data can be edited, wells deleted and recovered, and drawing of plan views and cross sections can begin. The tutorial exercise suggests plotting of one plan view and one cross section. The plot files used to create Figures 7-11 are included on the release disk. Using your word processing program you can create plot control files for other views of this data.

Plan views plotted at the same scale as the base, with well numbers posted enable easy checking of data entered from the digitizer. Data dumps made using Option 8 can be compared with the input data to check keyboard entry. Changes can be made from the keyboard of the computer using Option 7.

Values for coordinates of a well can be changed either from the keyboard or by redigitizing the location. The program allows the user to change unit lithology, depth to top and depth to bottom for individual units, and provides for the deletion or addition of unit records.

We have found that the drawing of cross sections at an early stage is useful for checking data entry and the consistency of well data.

A data base is tied to specific map corners for digitizing (default corners) but maps with different corner coordinates can be digitized by specifying these coordinates during the digitizing procedure.

The data base "EXAMPLE" is included, so that you can try plotting without taking the time to enter well data, if you choose. Use of this data base and associated files can also serve to check the configuration of the system. GSLEDIT is a powerful tool in the viewing and editing of a GSLITH data base. Its use will greatly aid in spotting errors, and enabling a direct fix.

A summary of the contents of plot control files is provided on the next page; by this time it should mean something to you.

## GSLITH Plot Control Files for Sections, Options 9 and 10

Record Number      Contents

|    |                                                                                           |                  |                                   |
|----|-------------------------------------------------------------------------------------------|------------------|-----------------------------------|
| 1  | Section type= 1-4                                                                         |                  |                                   |
| 2  | BASE ELEV, TOP ELEV, VERT SCALE NUMERATOR FT/IN, TICK INTERVAL FT, WELL WIDTH IN          |                  |                                   |
| 3  | HORIZONTAL SCALE DENOMINATOR                                                              |                  |                                   |
| 4  | XOFF IN, YOFF IN (OFFSETS ON PLOTS)                                                       |                  |                                   |
| 5  | Y OR N (PLOTTER ROTATION)                                                                 |                  |                                   |
| 6  | SPEED, FORCE (PLOTTER)                                                                    |                  |                                   |
| 7  | WIDTH IN, HEIGHT IN (LABELSIZE)                                                           |                  |                                   |
| 8  | STRAT ALIGNMENT TRUE="NOSTRAT" BASE Or @1000'="Or,,1000" CONTACT Or/Oc@1000'="Or,OC,1000" |                  |                                   |
| 9  | LEGEND Y/N NO=N,0,0 YES=Y,X IN, Y IN                                                      |                  |                                   |
| 10 | LATITUDE, LONGITUDE (LEFT END OF SECTION)                                                 |                  |                                   |
| 11 | LATITUDE, LONGITUDE (RIGHT END OF SECTION)                                                |                  |                                   |
| 12 | TYPE 1=DIST in FEET FROM SECT LINE                                                        | TYPE 2="WELL ID" | TYPE 3&4=FILENAME OF WELL LISTING |
| 13 |                                                                                           | TYPE 2="WELL ID" |                                   |
| 14 |                                                                                           | " etc."          |                                   |
| 15 |                                                                                           | " etc."          |                                   |
| 16 |                                                                                           |                  |                                   |
| ↓  |                                                                                           |                  |                                   |
| ↓  |                                                                                           |                  |                                   |

Plot control files for sections types 1, 3, and 4 end with record 12.

Use as many records as required for Type 2 sections to specify wells to be plotted.

Or and Oc above are used as examples of unit identifiers.

## GSLEDIT Plot Control Files for Sections

Record Number      Contents

|   |                                                                                  |
|---|----------------------------------------------------------------------------------|
| 1 | XSCALE DENOMINATOR, YSCALE DENOMINATOR                                           |
| 2 | BASE ELEV, TOP ELEV, VERT SCALE NUMERATOR FT/IN, TICK INTERVAL FT, WELL WIDTH IN |
| 3 | PEN=COLOR #, SYMBOL #, WELL WIDTH IN                                             |

## GSLITH Plot Control files for Plan Views, Option 11

Record Number      Contents

|    |                                                                                           |
|----|-------------------------------------------------------------------------------------------|
| 1  | Plan type= 1-11                                                                           |
| 2  | LATITUDE, LONGITUDE (NW corner of plot area)                                              |
| 3  | LATITUDE, LONGITUDE (SW corner of plot area)                                              |
| 4  | LATITUDE, LONGITUDE (SE corner of area)                                                   |
| 5  | LATITUDE, LONGITUDE (NE corner of plot area)                                              |
| 6  | XSCALE, YSCALE DENOMINATOR                                                                |
| 7  | XOFF IN, YOFF IN (OFFSETS ON PLOTS)                                                       |
| 8  | Y OR N (PLOTTER ROTATION)                                                                 |
| 9  | SPEED, FORCE (PLOTTER)                                                                    |
| 10 | WIDTH IN, HEIGHT IN (LABELSIZE)                                                           |
| 11 | STRAT ALIGNMENT TRUE="NOSTRAT" BASE Or @1000'="Or,,1000" CONTACT Or/Oc@1000'="Or,OC,1000" |
| 12 | Type 1-10 PEN #, SYMBOL #, SYMBOL SIZE 1/1000 IN Type 11 ELEVATION SLICE, SQUARE SIZE IN  |
| 13 | — Type 5-7 "Or", Type 8 contact "Ocs", "Or", Type 9 upper contact "Ocs", "Or",            |
| 14 | Type 9 lower contact "Or", "Oj"                                                           |

Plot control files for plan view types 1-4 and 10-11 end with record 12.

Plot control files for plan view types 5-8 end with record 13

Plot control files for plan views type 9 end with record 14

Or, Oj and Ocs above are used as examples of unit identifiers.

## CHAPTER 10

### Map projections and projection parameter files

Map projections and USGS practice are described by Snyder, (1982), in U.S. Geological Survey Bulletin 1532 and Snyder (1987), Professional Paper 1395. Information on the map projection is given in marginal notes on USGS maps, but the data on the parallels and meridian used to prepare the map is not provided. The summary below should help, but please read the original by Snyder. This bulletin and the professional paper answer questions you should have. Unless otherwise stated on the map margin or in Snyder's reports, use the Clarke 1866 Ellipsoid.

#### Small-Scale Maps

##### Maps labeled Albers Equal-Area projection

When used for maps of the 48 conterminous states, the standard parallels are 29,30,0,N and 45,30,0,N. The central meridian is 96,0,0,W.

For maps of Alaska, the standard parallels are 55,0,0,N and 65,0,0,N. The central meridian is 154,0,0,W.

For maps of Hawaii, the standard parallels are 8,0,0,N and 18,0,0,N. The central meridian is 157,0,0,W.

##### Maps labeled Lambert Conformal Conic

The Lambert conformal conic is used by the USGS for a map of the US showing all 50 states in true relative position. This map has been issued at scales of 1:6,000,000 and 1:10,000,000. For this map the standard parallels are 37,0,0,N and 65,0,0 N. The central meridian is the line of longitude at the center of the sheet.

##### Maps labeled Transverse Mercator

In 1979 a spherical form of the Transverse Mercator was chosen for a base map of North America at a scale of 1:5,000,000 for tectonic and other geologic maps. The scale factor along the central meridian of 100,0,0,W longitude is reduced to 0.926, see projection parameter file Example 7 below, p.310.

#### State-Scale Maps (1:500,000)

For the 500,000-scale base maps of the 48 contiguous states, the Lambert projection was used. The standard meridian is the line of longitude central to the map.

#### 1 x 2 Degree Maps (1:250,000)

##### Maps labeled Transverse Mercator

Army Map Service (AMS) 1 degree by 2 degree sheets use the Transverse Mercator projection. The principal meridian is the line of longitude central to the map.

##### Maps labeled Universal Transverse Mercator (UTM)

The UTM projection will be used by the USGS for 1 x 2 degree sheets as it updates the AMS series. The proper central meridian can be determined either by using tables listing the central meridian for the UTM Zone or by locating the nearest line of longitude of whole number of degrees that is divisible by 3 but not by 2.

### 30' x 60' Maps (1:100,000)

For all new 30 minute by 60 minute quadrangles, the UTM projection is used. The proper central meridian can be determined either by using tables listing the central meridian for the UTM Zone or by locating the nearest line of longitude of whole number of degrees that is divisible by 3 but not by 2.

### 15' Quadrangles (1:62,500)

#### Maps labeled Polyconic

Many 15 minute quadrangle maps have been drawn using the Polyconic projection. The central meridian is the line of longitude central to the map.

### 7 1/2' Quadrangles (1:24,000)

#### Maps labeled Polyconic

Many 7 1/2 minute quadrangle maps have been drawn using the Polyconic projection. The central meridian is generally the line of longitude central to the map. Use of this line as the central meridian won't cause problems.

#### Maps labeled Lambert or Transverse Mercator

Beginning in the late 1950's the USGS began using projections that were based on the parameters that serve as the basis of the State Plane Coordinate system. Depending on the state, the projection will be Lambert Conformal Conic, Transverse Mercator, or Oblique Mercator (panhandle of Alaska only). USGS Bulletin 1532 (Snyder, 1982) presents an excellent description of the basis of the SPCS and the projection that is used for each State. This Bulletin also describes in Table 8 the projection parameters that are used for each zone of each State. Table 8 lists a scale reduction for Transverse Mercator such as 1:2500. The projection file requires a scale factor. The formula to compute scale factor from scale reduction is  $\text{scale factor} = 1.0 - (1/\text{scale reduction})$ , i.e. a 1:2500 scale reduction results in a scale factor of 0.9996 or  $\text{scale factor} = 1.0 - (1.0/2500) = 0.9996$ . A useful approximation for digitizing and plotting is to use the Polyconic Projection. The maximum difference in the 700-800 mm diagonals of 7 1/2 or 15 minute quadrangles between Transverse Mercator, Lambert, and Polyconic projections is about 0.05 mm. This is a much smaller figure than that expected due to size changes due to changes in humidity for a paper copy. It is only twice the accuracy attributed to a good digitizer.

### Projections supported by Version 9.0

#### Cylindrical:

Mercator, Transverse Mercator, Universal Transverse Mercator, Oblique Mercator

#### Conic:

Polyconic, Lambert Conformal Conic, Albers Equal Area, Equidistant Conic

#### Pseudocylindrical (and new to System 9)

Van der Grinten, Robinson, Sinusoidal

PROJECTION FILES FOR LEVEL 9 SOFTWARE  
Examples of Projection Files

Latitude, Longitude values are entered in Degrees, Minutes, Seconds and followed by the appropriate letter designating compass direction: for example, W longitude, N latitude in the conterminous U.S. Equatorial and polar radii are specified in kilometers.

#### Universal Transverse Mercator

| File      | Description of Contents                      |
|-----------|----------------------------------------------|
| 1         | "1" designates Universal Transverse Mercator |
| 6378.2064 | Equatorial radius, in km, Clarke 1866        |
| 6356.5838 | Polar radius in km, Clarke 1866              |
| 105,0,0,W | Longitude, Principal Meridian of UTM Zone    |
| 0.9996    | Scale factor                                 |

#### Albers Equal Area

| File      | Description of contents               |
|-----------|---------------------------------------|
| 2         | "2" designates Albers Equal Area      |
| 6378.2064 | Equatorial radius, in km, Clarke 1866 |
| 6356.5838 | Polar radius in km, Clarke 1866       |
| 45,30,0,N | Latitude, first standard parallel     |
| 29,30,0,N | Latitude, second standard parallel    |
| 100,0,0,W | Longitude, meridian central to map    |

#### Lambert Conformal Conic

| File      | Description of contents                |
|-----------|----------------------------------------|
| 3         | "3" designates Lambert Conformal Conic |
| 6378.2064 | Equatorial radius, in km, Clarke 1866  |
| 6356.5838 | Polar radius in km, Clarke 1866        |
| 33,0,0,N  | Latitude, first standard parallel      |
| 45,0,0,N  | Latitude, second standard parallel     |
| 105,0,0,W | Longitude, meridian central to map     |

#### Mercator

| File      | Description of contents               |
|-----------|---------------------------------------|
| 4         | "4" designates Mercator               |
| 6378.2064 | Equatorial radius, in km, Clarke 1866 |
| 6356.5838 | Polar radius in km, Clarke 1866       |
| 105,0,0,W | Longitude, Meridian Central to map    |



## Polyconic

| File      | Description of contents               |
|-----------|---------------------------------------|
| 5         | "5" designates Polyconic              |
| 6378.2064 | Equatorial radius, in km, Clarke 1866 |
| 6356.5838 | Polar radius in km, Clarke 1866       |
| 105,0,0,W | Longitude, meridian central to map    |

## Transverse Mercator

| File      | Description of contents               |
|-----------|---------------------------------------|
| 6         | "6" designates Transverse Mercator    |
| 6378.2064 | Equatorial radius, in km, Clarke 1866 |
| 6356.5838 | Polar radius in km, Clarke 1866       |
| 105,0,0,W | Longitude, meridian central to map    |
| 0.9996    | Scale factor                          |

## Parameters of special DNAG map for spherical Earth

| File      | Description of contents            |
|-----------|------------------------------------|
| 6         | "6" designates Transverse Mercator |
| 6371.204  | Radius of Earth in km              |
| 6371.204  | Radius of Earth in Km              |
| 100,0,0,W | Longitude, meridian central to map |
| 0.926     | Scale factor unique to this map    |

## Oblique Mercator Projection

The sample oblique mercator projection file provides parameters used in generating the Appalachian Map

| File      | Contents                               |
|-----------|----------------------------------------|
| 7         | "7" designates Oblique Mercator        |
| 6378.2064 | Equatorial radius, in km, Clarke 1866  |
| 6356.5838 | Polar radius in km, Clarke 1866        |
| 1.0       | Scale factor along central axis        |
| 42,0,0,N  | Latitude, center point of projection   |
| 73,0,0,W  | Longitude, center point of projection  |
| 51,30,0,N | Latitude, S end of line defining axis  |
| 56,0,0,W  | Longitude, S end of line defining axis |
| 33,30,0,N | Latitude, N end of line defining axis  |
| 84,30,0,W | Longitude, N end of line defining axis |

## Equidistant Conic

| File       | Description of contents            |
|------------|------------------------------------|
| 8          | "8" designates Equidistant Conic   |
| 6378.38584 | Radius of Earth in km              |
| 6356.910   | Radius of Earth in Km              |
| 9,0,0,N    | Latitude, first standard parallel  |
| 4,0,0,N    | Latitude, second standard parallel |
| 66,0,0,W   | Longitude, meridian central to map |

Values in this example are for Venezuela maps labeled "Proyeccion Conico Secante Compensada." This projection is also used for certain maps in Alaska labeled "Modified Mercator", see Snyder, (1982).

## Pseudocylindrical projections Van der Grinten, Robinson and Sinusoidal

### Van der Grinten

| File       | Description of contents            |
|------------|------------------------------------|
| 9          | "9" designates Van der Grinten     |
| 6378.38584 | Radius of Earth in km              |
| 6356.910   | Radius of Earth in Km              |
| 100,0,0,W  | Longitude, meridian central to map |

### Robinson

| File       | Description of contents            |
|------------|------------------------------------|
| 10         | "10" designates Robinson           |
| 6378.38584 | Radius of Earth in km              |
| 6356.910   | Radius of Earth in Km              |
| 100,0,0,W  | Longitude, meridian central to map |

### Sinusoidal

| File       | Description of contents            |
|------------|------------------------------------|
| 11         | "11" designates Sinusoidal         |
| 6378.38584 | Radius of Earth in km              |
| 6356.910   | Radius of Earth in Km              |
| 100,0,0,W  | Longitude, meridian central to map |

### Special precautions when using the pseudocylindrical projections, Van der Grinten, Robinson and Sinusoidal

The Van der Grinten, Robinson, and sinusoidal projections are used for small scale maps, generally for the entire world or for a significant part of the surface. Special consideration in setting plot file corners and data elements are required when using these map projections. Rules are provided below.

1. Plot corners must be set to include the maximum and minimum latitude/longitude and plot Y and X values. To plot a world map from 85 degrees South latitude to 85 degrees North latitude, and 180 degrees West longitude to 180 degrees East longitude, the plot corners must be specified as below:

85,0,0,N,180,0,0,W

0,0,0,N,180,0,0,W

85,0,0,S,180,0,0,E

0,0,0,N,180,0,0,E

2. No line in the data base can cross the eastern edge of the map (because coordinates for such a line would go from a large positive latitude value to a large negative value. Use GSMUTIL to trim lines at the chosen Eastern boundary. This problem will be displayed on plots as a horizontal line extending completely across the plot from one edge to the other. Use GSMUTIL to trim the data in the data base to the edge of the chosen plot.

3. Choose the meridian in the projection parameter file such that the eastern and western limits are not more than 180 degrees from it.

4. When generating geodetic grids, using GSMUTIL observe rule 2 above. But you can specify a longitude greater than 180 degrees West. For example, if using a meridian central to the map of 100 degrees West, specify a western limit of 280 degrees West longitude, 80 degrees East longitude; resist the temptation to go to 90 degrees North or South latitude. These grids should be prepared for particular plots, not used in ways that disregard rule 2 above.

The Robinson projection is implemented as used by the National Geographic Society (Snyder, 1990). The scale reported for the map is the scale along the Standard Parallels, latitudes 38 degrees North and 38 degrees South. Some maps give the scale along the Equator. To match such maps, multiply the scale in the plot control file by a factor of 0.8487.

### Special precautions when using NAD 83

Polar and equatorial radii provided in the sample projection files generally are those of Clarke, 1866. If working with maps drawn in NAD 83 coordinates, the proper radii are those of the worldwide datum called WGS 84 (Snyder, 1987, p. 12).

6,378,137 m (Equatorial)

6,356,752.3 m (Polar)

Latitude and longitude control points must be located by NAD 83 coordinates.

The computer programs translating coordinates between NAD 27 and NAD 83 won't be applicable unless you stick with a single coordinate system. At the present time, use NAD 27.

## CHAPTER 11

### Coding of symbols

The file named CONFIG9.SYM contains the definitions of symbols used by GSMAP. The file is an ASCII file that can be modified by use of a word processing program to modify standard symbols or add new symbols. New symbols can be encoded by the user and added to the CONFIG9.SYM file. Coding is easier than might be anticipated. Symbols are drawn with straight lines and/or with circles. Closed polygons defined by lines or circles may be filled. Symbols may be posted with the number specified in P2 if desired. The CONFIG9.SYM file is limited to 2,000 lines; the standard file released with Version 8 has about 1,500 lines, and so has room to grow.

#### Coding of new symbols

Any unused number with three digits or less can be selected for a new symbol. The numbers 200-299 have special uses, as these define individually rotatable symbols that are rotated according to Parameter 1 and can be posted with numerical values drawn from Parameter 2 in the data base.

##### Starting

To be consistent with other symbols, sketch a square with sides of unit length and a point at the center. Fig. 41 provides examples. Assume that the pen is at the center point of the square. Each line of the code describing the symbol provides one instruction to the computer. The center of the square locates the point digitized. A symbol is drawn using straight line segments (moves) and circles. Moves can be either with pen up (no line drawn) or with pen down (line drawn). Moves can be combined to define polygons which will be filled (solid fill). Circles may either be filled or not filled.

The first line of the code for a symbol specifies the number assigned to the symbol and the number of lines (records) required to define that symbol, the X and Y coordinates of the reference point for posting, and the size (in inches) of the height of the numbers to be posted (0's if no posting is desired). Subsequent lines consist of a series of instructions for the plotter. No more than 25 lines may be used.

##### Moves

A line starting with a "PU" tells the plotter to move to a new position with the PEN UP (no line drawn); a line starting with "PD" specifies that the move is made with PEN DOWN (drawing a line). All moves are relative to the last point. After the "PU" or "PD" at the start of a line a comma must be used; the number after this comma specifies the X distance to the next point, then a comma must be used; the number after the second comma specifies the Y distance to the next point.

##### Polygons

A line starting with a "PM" is an instruction to the plotter about a polygon.

"PM",0,0 defines the start of a polygon.

"PM",2,0 ends a polygon and ends polygon mode for the symbol.

The polygon defined between "PM",0,0 and "PM",2,0 instructions will be filled with a solid pattern.

Moves between "PM",0,0 and "PM",2,0 instructions should define a closed polygon; if the polygon is not closed, the "PM",2,0 instruction forces a closing of the exterior polygon to the point occupied by the pen when the "PM",0 instruction was issued.

## Exterior and interior polygons

"PM",1,0 ends a polygon but leaves the computer in polygon mode. This instruction is used, for example, between moves that define an external polygon and moves that define an internal polygon to be left unfilled.

The "PM",1,0 instruction forces a closing of the polygon back to the position at the time the "PM",0,0 instruction was issued.

## Circles

A line of code starting with a "CI", instruction calls for the drawing of a circle. The "CI" must be followed by a comma. The number following the comma specifies the diameter of the circle to be drawn. This number is followed by a comma, then by a 0 (zero). The diameter is specified in units relative to the unit square as discussed at the start of this section.

The center of the circle is the point occupied by the pen at the time the "CI" instruction is given. A "CI" instruction defines a complete polygon; it is equivalent to a set of moves between "PM",1,0 instructions, but counts as a single line.

## Reference position for posting of symbols Code Group 200-299

A reference position for posting of numbers is given in the first line defining the symbol following the symbol number and number of moves and before the number specifying the size of the posted numbers. This reference position is defined in the coordinate space of the unit box used for coding of the symbols. Check symbols with posting in the CONFIG9.SYM file for examples, especially study definitions of symbols 201 and 202. 0's are used for positions and height of characters for symbols without posting.

Additional information on coding is given in the Interfacing and Programming Manual supplied with HP plotters. Please note that not all HPGL commands are supported by level 8 programs. Use only the commands provided above. Examples of the coding of symbols are diagramed on Fig. 41.

## Symbol 209; Uses PU and PD moves

209,6,0,0,0 - symbol number, number of lines of code,0's indicate no posting

"PU",0.2,-0.5

"PD",0.0,1.0

"PD",0.1,-0.2

"PU",-0.5,0.2

"PD",0.0,-1.0

"PD",-0.1,0.2

Symbol 14; Uses PU and PD moves, and one filled polygon

14,8,0,0,0 -symbol number, number of lines of code, 0's indicate no posting  
"PU",0.5,0.5 - move to the upper right corner of symbol; PU  
"PD",-1.0,0.0 - move to upper left corner; PD  
"PD",0.0,-1.0 - move to lower left corner; PD  
"PM",0,0 - starts polygon to be filled  
"PD",1.0,0.0 - move draws lower line of filled triangle  
"PD",0.0,1.0 - move draws right edge of filled triangle  
"PD",-1.0,-1.0 - move draws hypotenuse of filled triangle  
"PM",2,0 Ends definition of filled polygon

- Filling of triangular polygon

Note: the "PM",0,0 instruction starts definition of a polygon to be filled; the PM",2,0 ends the polygon's definition

Symbol 77, uses PU and PD moves, and two circles defined as exterior and interior polygon.

77,14,0,0,0  
"PU",0,1.0  
"PD",0,-0.5  
"PU",0,-0.5  
"PM",0,0 -starts filled polygon = circle  
"CI",-5,0 -specifies circle, diameter 0.5  
"PM",2,0 -ends filled polygon = circle  
"PU",0,-0.5  
"PD",0,-0.5  
"PU",-1.0,1.0  
"PD",0.5,0.0  
"PU",1.0,0.0  
"PD",0.5,0  
"PU",-1.0,0.0  
"CI",1,0 open circle; polygon not specified; circle will not be filled

- The "units" for the diameter of the circles are specified in the same "units" as the "moves" for the pen, based on the unit square.

- Lines for symbol 77 go outside the unit square; this is permissible. The only reason for the unit square is to assist in keeping symbols similar in size.

- Symbol 209 with coding as drawn here was found to be too small; it has been enlarged in the standard set.

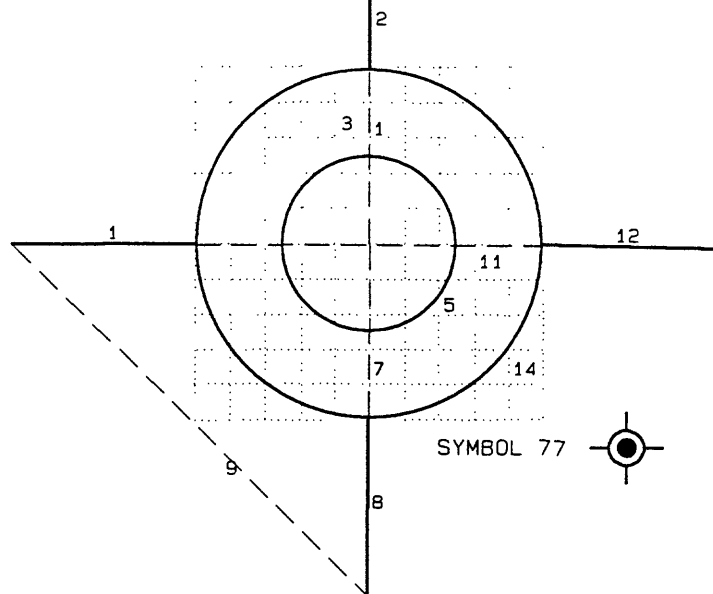
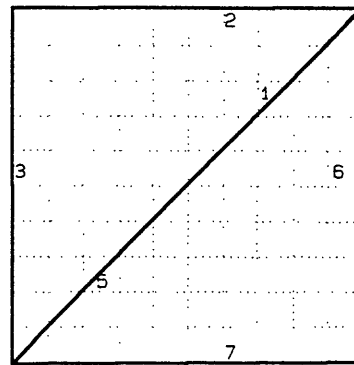
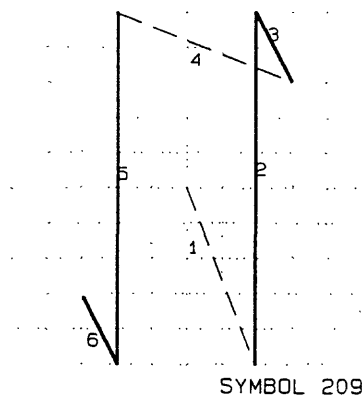


Figure 41. Examples of coding of symbols. Unit square shown by dotted lines, pen up moves by dashed lines, pen down moves by solid lines.

## CHAPTER 12

### HARDWARE INSTALLATION AND CONFIGURATION FILES

This section deals with the physical installation of the digitizer and plotter, the connection of these devices to the computer, and verification of correct installation. A worksheet is supplied to assist recording of settings. The makeup of configuration files and modifications required to tune the files to specific hardware configurations is also described. The plotter and the digitizer must be connected to serial ports; there must be a match between the port connections, the communications parameters of these devices, and the settings of the programs. The printer must be connected to parallel port #1 (LPT1:).

#### Standard configuration files

Three configuration files named CONFIG9.DIG, CONFIG9.PLT, and CONFIG9.SCR, for the digitizer, plotter, and screen (monitor) may require modification to match your computer system. The file CONFIG9.SYM contains the definitions of symbols and does not require modification.

The configuration files CONFIG9.DIG, CONFIG9.PLT, and CONFIG9.SCR supplied on Disk #1 can be used without modification IF the conditions below are satisfied.

- The digitizer is connected to COM2 and set to 1200 baud and is a GTCO Digi-Pad 5, or emulates the GTCO set as recommended in the section that follows.
- The plotter is connected to COM1, and set to 2400 baud, and set as recommended below.
- The monitor and graphics card utilize the color VGA mode.

If these conditions are not satisfied, modifications must be made. Normally only the first line of each file must be changed. Use a word processing program that does not leave embedded characters.

#### Location of configuration files

The DOS operating system looks for files only in certain places, for example, it will find .EXE, .BAT, and .COM files in directories specified by the PATH statement in the AUTOEXEC.BAT file as well as in the active directory. The configuration files and font files needed by application programs such as GSMAP must either be in the active directory, or in Version 8, can be located in a different directory specified by setting the environmental variable GSFILES= to this specified directory.

Add the statement SET GSFILES=C:\XX (C:\XX is the complete DOS name of the directory where these files will be located) to your AUTOEXEC.BAT file. Copy the configuration and font files in it. No other copies will be required on your system. If you set the environmental variable, but leave the configuration files in the active directory without copying them into their allocated directory, DOS will tell you that they are missing. It won't look in both places.



## INSTALLATION WORKSHEET

### DIGITIZER

|           |       |                       |       |
|-----------|-------|-----------------------|-------|
| Port      | _____ | Key Char position     | _____ |
| Speed     | _____ | X Coordinate Starting | _____ |
| Parity    | _____ | Width of X Coordinate | _____ |
| Bits/Char | _____ | Y Coordinate Starting | _____ |
| Stop bits | _____ | Width of Y Coordinate | _____ |

#### Non Numeric Keys:

|           |       |              |       |            |       |
|-----------|-------|--------------|-------|------------|-------|
| A Labeled | _____ | Transmits as | _____ | ASCII code | _____ |
| B Labeled | _____ | Transmits as | _____ | ASCII code | _____ |
| C Labeled | _____ | Transmits as | _____ | ASCII code | _____ |
| D Labeled | _____ | Transmits as | _____ | ASCII code | _____ |
| E Labeled | _____ | Transmits as | _____ | ASCII code | _____ |
| F Labeled | _____ | Transmits as | _____ | ASCII code | _____ |

ASCII codes are listed in the back of the BASIC Manual

### PLOTTER

|           |       |
|-----------|-------|
| Port      | _____ |
| Speed     | _____ |
| Parity    | _____ |
| Bits/Char | _____ |
| Stop bits | _____ |

## HARDWARE INTERFACES

### DIGITIZER

Programs of System 9 support digitizers that meet the following criteria:

1. The digitizer transmits information to the computer via a cable attached to a serial communication adaptor that uses the RS232C standard.
2. a single record consisting of ASCII characters followed by a carriage return is transmitted each time a key is depressed on the pointing device(keypad/cursor/stylus).
3. Each record contains (at a minimum) the X and Y coordinate of the location of the pointing device.

Two methods of operating are provided: keypad and menu. The keypad method requires that the digitizer have a sixteen button cursor keypad that transmits a code indicating the key that was depressed in addition to the X,Y coordinate location of the cursor on the digitizer. Certain keys are used at critical times to communicate the user's desires. For example during entry of an attribute code the A key indicate end of field. The menu method requires the use of a 2x2 inch menu that is located on the digitizer within the active area and whose location (lower left and upper right corners) must be registered at the start of a digitizing session. An attribute code is entered by placing the cursor over the number or letter and depressing a key or the stylus. In menu mode the position coordinates are scanned and if the point is within the menu area, the point is translated to the letter or number labeled within the circle.

The user must verify that communication between the computer and the digitizer is working correctly. Note that this procedure is best accomplished by the use of the documentation accompanying the digitizer for setting parameters via switches or by the use of a separate software program that sets the parameters. Experience has indicated that a speed of 1200 baud is very adequate for entering data in point mode. This speed may seem slow but has proved to work satisfactorily within almost any combination of serial adaptor, computer and digitizer. Certain combinations simply will not operate at higher speed without generating I/O errors.

BASICA Program to test digitizer communications and format of information transmitted when a key is depressed.

```
10 OPEN "COM2:1200,N,8,1" FOR INPUT AS #1
20 PRINT "HIT KEYS ON DIGITIZER ONE AT A TIME"
30 LINE INPUT #1,DSTRING$
40 PRINT DSTRING$
50 GOTO 30
60 END
```

The user must know the format of the information contained within the ASCII string that is transmitted when a key is depressed on the digitizer. In the menu mode the starting position and width of the X and Y coordinates within the string must be known. In the keypad method the character(s) transmitted to identify each key uniquely and the starting position and width of the X and Y coordinates within the string must be known. The procedure is to start BASIC running and type in the program carefully. The first line must identify the serial port you are attaching to the digitizer (COM1: or COM2:), and the speed, parity and number of stop bits you have set using the switches (hardware or software settings).

Start the BASIC program running by depressing the F2 key and the screen should contain the message "HIT KEYS ON DIGITIZER ONE AT A TIME". Hold the cursor in a fixed position and depress each key. For a 16-button cursor I recommend that you lightly touch the keys in the sequence 0,1,2,...,9 and then A,B,...,E,F. For a menu mode simply depress the keys to verify each key will cause a line to be transmitted. For a keypad you should see sixteen lines of text on the screen. If the text is double spaced, you have the switches set to transmit a carriage return followed by a line feed. This will work successfully with GSMAP Version 9.Hit the Control Break keys after the program runs, then exit to the system.

Examine the lines of text. You should be able to identify the X and Y coordinates on each line and also a one or two character field that indicates the code that is being transmitted to indicate the key that was depressed. Dump the screen to the printer using the Ctrl-PrtSc keys. This information should be recorded on the form in the program documentation. It provides the basis of the translation table part of the CONFIG9.DIG file. The starting position and width of the fields containing the X and Y coordinate and whether a decimal point is being transmitted should also be recorded. For a digitizer implemented using the MENU approach, the critical information is the starting position and width of the X and Y coordinates.

After this information is gathered, it is stored in a file called CONFIG9.DIG so that GSMAP can communicate with the digitizer and translate the information properly. The structure of the CONFIG9.DIG differs, depending on the method used, keypad or menu.

## CONFIG9.DIG

### Keypad

The first line of the file contains the specifications of communications parameters. This information is enclosed by a set of double quotes ("). The program uses this string to establish communication between the serial port of the computer and the digitizer. The following example assumes that the digitizer has been attached to the computer by a cable plugged into serial port #1 on the computer and that the digitizer has been initialized (via switches or software) to transmit at a rate of 1200 baud (bits per second), no parity, eight bits per character, and 1 stop bit per character.

The second line indicates that the digitizer contains a keypad and that the keys on the keypad will be utilized to enter data. The third line states that when a key is depressed on the keypad the first character of the character string transmitted represents the key that was depressed. The fourth line indicates that five characters starting with character 2 contain the X coordinate position on the digitizer board and that the coordinate should be multiplied by 0.001 to convert the coordinate to inches. The fifth line duplicates the fourth line except the Y coordinate of the position on the digitizer board. The sixth line indicates that all sixteen keys on the keypad are to be translated using the sixteen lines that follow. The following sixteen lines contain the ASCII code that is transmitted when a key is depressed followed by the ASCII code that it should be translated to for use by the GSMAP program. Example - a GTCO has a keypad labeled with keys numbered 0 to 9 and A to F. However, when the A key is depressed, an ASCII code of : is transmitted. The translation table indicated to GSMAP that when a : is received in the first character of the transmitted string it should be translated to A which indicate the "end of field" function.

The remaining seven lines of the example provide a method of customizing the sounds that are emitted by the computer indicating that the computer is prompting for information to be entered on the digitizer, that entry of a field has been completed or that an error has occurred. The screen also provides prompts and error messages but the audible sounds allow the user to verify that GSMAP and the user are in sequence and that a key on the keypad was depressed. The information on each line consists of a frequency and a duration. The frequency is expressed in hertz (cycles/second) within the range 37-32,767. The duration is the duration in clock ticks (18.2 clock ticks per second). A duration value of 18.2 would cause the sound for one second; a value of zero will cause no sound to be generated. After a user becomes accustomed to the rhythm of GSMAP data entry, it may be desirable to turn off the sounds or to mute them if they annoy other people in the immediate area.

# Example of KEYPAD FILE CONFIG9.DIG

"COM2: 1200,N, 8, 1"

"KEYPAD"

1,1

2, 5, .001

8, 5, .001

16

0,0

1,1

2,2

3,3

4,4

5,5

6,6

7,7

8,8

9,9

:,A

;,B

<,C

=,D

>,E

?,F

196,2

261,6.5

349,6.5

440,6.5

1760,9.100001

100,9.100001

130.810,6.5

## Menu

### First line

This line contains the communications parameters definition. This information is enclosed by a set of double quotes ("). The program uses this string to establish communication between the serial port of the computer and the digitizer. The following example assumes that the digitizer has been attached to the computer by a cable plugged into serial port #1 on the computer and that the digitizer has been initialized (via switches or software) to transmit at a rate of 1200 baud (bits per second), no parity, eight bits per character, and 1 stop bit per character. The cursor can contain one, four or sixteen keys or can be a stylus. We do NOT recommend the use of a stylus because the stylus point is generally large and does not provide an accurate method of pointing precisely.

The second line indicates that the digitizer will be operated using a 2 inch by 2 inch menu and that any key depressed while within the menu area should be translated by its position within the menu area.

The third line indicates that five characters starting with character 2 contain the X coordinate position on the digitizer board and that the coordinate should be multiplied by 0.001 to convert the coordinate to inches. The fourth line duplicates the third line except that it describes the Y coordinate.

The remaining seven lines of the example provide a method of customizing the sounds that are emitted by the computer indicating that the computer is prompting for information to be entered on the digitizer, that entry of a field has been completed or that an error has occurred. The screen also provides prompts and error messages but the audible sounds allow the user to verify that GSMAP and the user are in sequence and that a key on the keypad was depressed. The information on each line consists of a frequency and a duration. The frequency is expressed in hertz (cycles/second) within the range 37-32,767. The duration is the duration in clock ticks (18.2 clock ticks per second). A duration value of 18.2 would cause the sound for one second; a value of zero will cause no sound to be generated. After a user becomes accustomed to the rhythm of GSMAP data entry, it may be desirable to turn off the sounds or to mute them especially if they annoy other people in the immediate area.

### Example of MENU FILE CONFIG9.DIG

```
"COM2: 1200,N, 8, 1"  
"MENU"  
2, 5, .001  
8, 5, .001  
196,2  
261,6.5  
349,6.5  
440,6.5  
1760,9.100001  
100,9.100001  
130.810,6.5
```

Once you have verified that the computer and digitizer are communicating and have established your CONFIG9.DIG file, test GSMAP (Option 3) with the digitizer.

## HARDWARE INSTALLATION

### DIGITIZER

1. Connect the cable from the digitizer to one of the serial ports. Note whether the port is COM1 or COM2 on the worksheet.
2. Set the digitizer switches for the communications speed you want to operate; we have found 1200 baud to be satisfactory. Record the baud rate on the work sheet.
3. Set digitizer switches for parity; generally you will have a choice of the following:
  - S - SPACE: Parity bit always transmitted and received as a space (0 bit).
  - N -NONE: No parity transmitted or checked on receive.
  - O - ODD: Odd transmit parity, odd receive parity checking.
  - E -EVEN: Even transmit parity, even receive parity checking.
  - M -Mark: Parity bit always transmitted and received as a mark (1 bit); We normally use N. Record the setting on the worksheet.
4. Set the number of databits per character on the digitizer switches. The choice is generally 7 or 8. We use 8. Record the value on the work sheet.
5. Set the number of stopbits on the digitizer switches. The choice is 1 or 2; we use 1. Record the setting on the worksheet.
6. Set the digitizer switches to transmit a carriage return only; set switches to NOT transmit a line feed.

#### Implementation on GTCO DigiPad Digitizers

For the GTCO Digi-Pad series of digitizers connect a null-modem cable from the computer serial port (COM2:) to port J5 on the digitizer. The cable diagram is shown in the GTCO user's manual, appendix on RS232 interfacing, DTE-to-DTE cabling. The following switch settings are used.

| Settings |   |   |   |   |   |   |   |   | Alternate settings if previous settings set digitizer to incremental mode. |    |   |   |   |   |   |   |   |   |
|----------|---|---|---|---|---|---|---|---|----------------------------------------------------------------------------|----|---|---|---|---|---|---|---|---|
|          | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |                                                                            |    | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| S1       | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 = ON                                                                     | S1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |
| S2       | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 = OFF                                                                    | S2 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| S3       | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |                                                                            | S3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

#### For the GTCO SUPER L II

| Settings |   |   |   |   |   |   |   |   |
|----------|---|---|---|---|---|---|---|---|
|          | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| S1       | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| S2       | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| S3       | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |

1 = ON

0 = OFF

CONFIG9.DIG for GTCO Digi-Pad digitizers with 16-key keypads.

Parameters in this example apply to GTCO digitizers set up as recommended using the 16-key cursor. Annotations are not a part of the file. Normally only the first line of this file needs to be changed to accommodate individual systems. The final seven lines tune the frequency and duration of the sounds of the system during digitizing.

| File                 | Annotations (not a part of the file)                              |                             |
|----------------------|-------------------------------------------------------------------|-----------------------------|
| "COM2: 1200,N, 8, 1" | Port, baud rate, see OPEN COM, instruction                        |                             |
| "KEYPAD"             | Specifies use of multi-key cursor                                 |                             |
| 1,1                  | Position, # characters sent to identify key when a key is pressed |                             |
| 2, 5, .001           | Start position, field length X coordinate,resolution              |                             |
| 8, 5, .001           | Start position, field length Y coordinate,resolution              |                             |
| 16                   | Number of records below (keys to be used)                         |                             |
| 0,0                  | 0 key sends 0                                                     |                             |
| 1,1                  | 1 key sends 1                                                     |                             |
| 2,2                  | 2 key sends 2                                                     |                             |
| 3,3                  | 3 key sends 3                                                     |                             |
| 4,4                  | 4 key sends 4                                                     |                             |
| 5,5                  | 5 key sends 5                                                     |                             |
| 6,6                  | 6 key sends 6                                                     |                             |
| 7,7                  | 7 key sends 7                                                     |                             |
| 8,8                  | 8 key sends 8                                                     |                             |
| 9,9                  | 9 key sends 9                                                     |                             |
| :,A                  | A key sends :                                                     |                             |
| ;,B                  | B key sends ;                                                     |                             |
| <,C                  | C key sends <                                                     |                             |
| =,D                  | D key sends =                                                     |                             |
| >,E                  | E key sends >                                                     |                             |
| ?,F                  | F key sends ?                                                     |                             |
| 96,1                 | Frequency=96,duration=1                                           | Any key                     |
| 261,6.5              | Frequency=261,duration=6.5                                        | End entry of CODE           |
| 349,6.5              | Frequency=349,duration=6.5                                        | End entry of P1             |
| 440,6.5              | Frequency=440,duration=6.5                                        | End entry of P2             |
| 1760,9.1             | Frequency=1760,duration=9.1                                       | System ready to start entry |
| 100,9.1              | Frequency=100,duration=9.1                                        | Error                       |
| 130.810,6.5          | Frequency=130,duration=6.5                                        | E key to "Escape"           |

Note that the F key is defined in CONFIG9.DIG for Version 9; it wasn't with Versions previous to 7.

- For the "tunable" sounds:
- Frequency is specified in Hertz (cycles/sec).
- Duration is specified in "clock ticks": 12.1 ticks=1 second.
- For the GTCO SUPER L II, change line number 5 in the file above from

8,5, .001 to 7,5,0.001

## CONFIG9.DIG for GTCO digitizers for use with a Menu Template.

Parameters in the example below apply to GTCO digitizers using the **MENU** option (one key on the keypad is used). Annotations are not a part of the file. Normally only the first line of this file needs to be changed to accommodate individual systems.

| File                  | Annotations (not a part of the file)                                   |
|-----------------------|------------------------------------------------------------------------|
| "COM2: 9600,N, 8, .1" | Port, baud rate, see OPEN COM, instruction                             |
| "MENU"                | Specifies use of "Menu" on digitizer and digitizing using a single key |
| 2, 5, .001            | Start position, field length X coordinate, resolution                  |
| 8, 5, .001            | Start position, field length Y coordinate, resolution                  |
| 196,1                 | Frequency=196, duration=1      Any key                                 |
| 261,6.5               | Frequency=261, duration=6.5      End entry of CODE                     |
| 349,6.5               | Frequency=949, duration=6.5      End entry of P1                       |
| 440,6.5               | Frequency=440, duration=6.5      End entry of P2                       |
| 1760,9.1              | Frequency=1760, duration=9.1      System ready to start entry          |
| 100,9.1               | Frequency=100, duration=9.1      Error                                 |
| 130.810,6.5           | Frequency=130, duration=6.5      E key to "Escape"                     |



## Implementation on Summagraphics Microgrid II

### Switch settings:

|               |               |
|---------------|---------------|
| DIP SWITCH 1: | DIP SWITCH 2: |
| 3-4-5-6-ON    | 2-3-8 ON      |
| 1-2-7-8-OFF   | 1-4-5-6-7-OFF |

### CONFIG9.DIG

```
"COM1: 1200,E,7,1"
"KEYPAD"
15,2
2,5,0.001
9,5,0.001
16
14,0
01,1
02,2
03,3
05,4
06,5
07,6
09,7
10,8
11,9
13,A
15,B
04,C
08,D
12,E
16,F
96,1
261,6.5
349,6.5
440,6.5
1760,9.100001
100,9.100001
130.810,6.5
```

## Implementation on Summasketch II Professional, 16 button cursor

There are no external switches on this digitizer; settings are determined by software. A program SEND.COM is supplied with this digitizer. Before entering GSMAPI use the SEND.COM program to initialize the digitizer with the following: the word SEND is not case sensitive, the remainder is case sensitive. The ^[ sequence (uppercase6[]) is interpreted by the digitizer as an Escape sequence; ^ does not mean Ctrl in this sequence.

```
SEND /2/u/c^[M1^[MA^[C2
```

### CONFIG9.DIG

```
"COM1: 9600,E, 7, 2"
"KEYPAD"
17,2
1, 7, 1
9, 7, 1
16
14,0
01,1
02,2
03,3
05,4
06,5
07,6
09,7
10,8
11,9
13,A
15,B
04,C
08,D
12,E
16,F
96,1
261,6.5
349,6.5
440,6.5
1760,9.100001
100,9.100001
130.810,6.5
```

## Implementation on Summasketch professional (1201)

The Summagraphics SummaSketch Professional Model 1201 has three banks of switches located at the top of the back side. Switch banks SW2 and SW3 are deactivated. On switch group SW1 only switches 1,2, and 3 are active; all others are deactivated. As delivered the three switches are set as follows:

- 1=ON 9600 BAUD
- 2=ON BINARY DATA FORMAT
- 3=ON 8-BIT BYTE, ODD PARITY

These switches should be changed to the following:

- 1=ON 9600 BAUD
- 2=OFF ASCII DATA FORMAT
- 3=OFF 8-BIT BYTE, NO PARITY

After changing these switches the reset switch should be depressed (or the power shut off and then turned back on). The CONFIG9.DIG file should read as follows if the digitizer is connected to serial port 1:

### CONFIG9.DIG

```
"COM1: 9600,N, 8, 1"
"MENU"
1, 5, .001
7, 5, .001
96,1
261,6.5
349,6.5
440,6.5
1760,9.100001
100,9.100001
130.810,6.5
```

The Summasketch is internally set to operate in stream mode, 500 lines/inch, and there are no switches to reset these settings. We have included a small program called SUMSKETC.EXE that will send the appropriate commands to the digitizer to switch it to point mode, 1000 lines/inch. This program must be run every time the power is turned off or the RESET button depressed. The following program can be operated under BASICA, and is easily modified to change communication parameters to accommodate individual systems and set the Summasketch digitizer for use with the programs of this release, replacing SUMSKETC.EXE.

```
10 OPEN "COM1:9600,N,8,1" AS #1
20 PRINT #1,USING "I";"B";
30 PRINT #1,USING "I";"J";
40 CLOSE #1
50 END
```

## Implementation on the Summagraphics Microgrid II Professional Model MM2 1812 with 16 button cursor.

There are no external switches on this digitizer; settings are determined by software. A program SEND.COM is supplied with this digitizer. Before entering GSMAPI use the SEND.COM program to initialize the digitizer with the following: the word SEND is not case sensitive, the remainder is case sensitive. The ^[ sequence (uppercase6[]) is interpreted by the digitizer as an Escape sequence; ^ does not mean Ctrl in this sequence.

```
SEND /1/u/c^[M1^[MA^[C2
```

The CONFIG9.DIG file to be used with the above utility program "send" is as follows for a digitizer connected to serial port number 1:

### CONFIG9.DIG

```
"COM1: 9600,E,7,2"
"KEYPAD"
17,2
1, 7, 1
9, 7, 1
16
14,0
01,1
02,2
03,3
05,4
06,5
07,6
09,7
10,8
11,9
13,A
15,B
04,C
08,D
12,E
16,F
96,1
261,6.5
349,6.5
440,6.5
1760,9.100001
100,9.100001
130.810,6.5
```

## Implementation on Numonics digitizers

Settings used for one Numonics 2200/2400 digitizer

Switches from left to right, 1=on, 0=off

Switch bank B

00111011

Switch bank A

10110001

The keypad version of the CONFIG9.DIG file could not be used with this Numonics digitizer because the format of the ASCII response from the digitizer varied from key to key. 1.0 was used on the two lines following the "MENU" record to set the scale because the decimal point is supplied as a part of the X and Y coordinate string. The sample CONFIG8.DIG file below specifies that the digitizer set for 5 digits before the decimal point, 3 digits after the decimal point (the default is 4 and 3). On this digitizer the decimal point is sent as a part of the ASCII string.

### CONFIG9.DIG

"COM1: 1200,N, 8, 1"

"MENU"

4,9,1.0

15,9,1.0

96,1

261,6.5

349,6.5

440,6.5

1760,9.100001

100,9.100001

130.810,6.5

Settings used for Numonics 2200-.90.F Digitizer

Switch

A(DS-1) DS-2

1 OFF 1 OFF

2 ON 2 ON

3 ON 3 OFF

4 ON 4 ON

5 OFF 5 ON

6 OFF 6 OFF

7 ON 7 ON

8 ON 8 ON

The following keypad version of the CONFIG9.DIG file is in use with this Numonics digitizer.

### CONFIG9.DIG

"COM1: 1200,0, 7, 1"

"KEYPAD"

1,1

3,6,0.001

11,6,0.001

16

0,0

1,1

2,2

3,3

4,4

5,5

6,6

7,7

8,8

9,9

A,A

B,B

C,C

D,D

E,E

F,F

96,1

261,6.5

349,6.5

440,6.5

1760,9.100001

100,9.100001

130.810,6.5

## PLOTTER

GSMAP and other programs that support plotters work with plotters that utilize the Hewlett-Packard Graphics Language (HPGL) or emulate HPGL. The program has been designed to operate at the lowest level of HPGL. The program should run successfully on plotters using 7475 level support of HPGL.

As with the digitizer, you must verify that communication between the computer and the plotter is working correctly. Note that this procedure is best accomplished by the use of the documentation accompanying the plotter for setting parameters via switches or built in software that allows you to set the parameters using toggle keys to set the parameters. Experience has indicated that a speed of 2400 baud is recommended. This speed may seem slow but has proved to work satisfactorily within almost any combination of serial adaptor, computer and plotter. Certain combinations simply will not operate at higher speed without generating I/O errors. This documentation provides switch settings for some of the plotters in common use.

The BASIC program printed below permits the user to confirm the interface is working correctly. This BASIC program is taken from the Operations and Interconnection Manual for the HP7550A Graphics Plotter. The program tests plotter communications and displays the model number of the plotter using the pen in carousel position 1.

```
10 OPEN "COM1:2400,N,8,1,RS,CS65535,DS,CD" AS #1
20 PRINT #1,"IN;OI;"
30 INPUT #1,ID$
40 PRINT #1,"SP1;PA500,500;"
50 PRINT #1,"LB";ID$;" COMMUNICATION OK";CHR$(3)
60 PRINT #1,"PAO,O;SP0;"
70 END
```

Start BASIC and enter the program carefully. The first line must reflect the serial port you have attached to the plotter (COM1: or COM2:), and the speed, parity and number of stop bits you have set using the switches. Start the BASIC program running by depressing the F2 key. The plotter should pick up pen #1 and draw a line of text that indicates communication is working correctly. If the test is successful, you should modify the first line of the CONFIG9.PLT file to indicate the serial port (COM1: or COM2:), speed, parity and number of stop bits.

The second line of the CONFIG9.PLT file contains three parameters that GSMAP uses when DRAFT mode plotting is specified by the user. The first two parameters are the width and height of the characters used to draw the entry number; the last parameter is the size of the circle drawn at the beginning and end points of line type data. We suggest that you use the values we have supplied until you have gained some experience and then you may want to customize these values. The remaining lines are parameters for the 18 different line patterns supported by GSMAP. Normally you should NOT modify these lines until you have considerable experience using GSMAP, and even then be very careful.

## PLOTTER INSTALLATION

1. Connect the cable from the plotter to the remaining asynchronous communications port; note on the worksheet whether it is connected to COM1 or COM2. If you have only one serial port you will have to use an external switch between the computer and the digitizer and plotter.
2. Set the plotter switches (hardware or software) for the communication speed at which you want to operate; we have found 2400 baud to work well. Record the baud rate on the worksheet.
3. Set the plotter switches for parity. Generally you will have a choice of the following:
  - S - SPACE: Parity bit always transmitted and received as a space (0 bit).
  - N -NONE; No parity transmitted or checked on receive.
  - O -ODD: Odd transmit parity, odd receive parity checking.
  - E -EVEN: Even transmit parity, even receive parity checking.
  - M -Mark: Parity bit always transmitted and received as a mark (1 bit); We use N. Record the setting on the worksheet.
4. Set the number of stop bits on the plotter switches. You will have a choice of 1 or 2; we use 1. Record the setting on the work sheet.
5. Check other settings on the plotter. We use the following:

Remote  
Standalone  
Handshake: hardwire Direct  
Duplex: Full

For the HP 7585B plotter the following switch settings apply: the cable must be connected to the COMPUTER/MODEM port; use the following settings.

### INTERFACE MODE

#### RS232C

NORMAL  
NORMAL  
STANDALONE  
NORMAL  
NORMAL

#### RS-232-C

Parity OFF  
ODD  
Duplex half-full FULL  
HARDWIRE  
DTR-BYPASS NORMAL

For the HP 7475 plotter, the following switch settings apply:

0 S2  
0 S1  
0 Y  
1 US  
0 B/A3-A/A4  
1 B4  
0 B3  
1 B2  
0 B1

## CONFIG9.PLT

The first line (record) of the CONFIG9.PLT file sets communication parameters between the computer and the plotter. Normally only the numbers specifying the serial port and the baud rate need to be modified to customize the file for a particular system. The print below calls for communication using serial port number 1 (COM1:) at a baud rate of 9600. The parameters on this line are described in any BASIC manual, see OPEN COM statement for details. The rest of the file contains the definitions of the patterns of line types 0-17. You can change these patterns using a text editing program.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre> "COM1: 9600,N, 8, 1,RS,CS65535,DS,CD" 0.04,0.06,0.025 1.0E38 1.0E38 -99 _____ Line type 0 0.01 0.03 -99 _____ Line type 1 0.07 0.02 -99 _____ Line type 2 0.15 0.02 -99 _____ Line type 3 0.15 0.035. 0.005 0.03 -99 _____ Line type 4 0.15 0.02 0.03 0.02 -99 _____ Line type 5 0.15 0.02 0.03 0.02 0.03 0.02 -99 _____ Line type 6 0.01 0.04 -99 _____ Line type 7 0.25 0.03 -99 _____ Line type 8 0.33 0.03 -99 _____ Line type 9 0.25 0.03 0.01 0.03 -99 _____ Line type 10 0.25 0.03 0.02 0.03 -99 _____ Line type 11 0.25 0.03 0.06 0.03 0.06 0.03 -99 _____ Line type 12 </pre> | <pre> COMMUNICATION PARAMETERS WIDTH HEIGHT OF LABEL CHARACTERS, CIRCLE SIZE, DRAFT MODE PLOTS  SOLID LINE GAP  LINE 0.01" GAP 0.03"  LINE 0.15" GAP 0.035" LINE 0.005" GAP 0.03" </pre> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

```

0.20
0.03
0.01
0.03
0.01
0.03
0.01
0.04
-99 _____ Line type 13
0.01
0.02
-99 _____ Line type 14
0.02
0.03
-99 _____ Line type 15
0.45
0.05
-99 _____ Line type 16
0.01
0.03
0.01
0.03
0.01
0.03
0.1
0.03
0.1
0.03
0.1
0.03
0.01
0.03
0.01
0.03
0.01
0.06
-99 _____ Line type 17

```

#### Rules for line patterns defined in CONFIG9.PLT

Line lengths (pen down) must always be followed by a gap length (pen up). Lengths can be specified to 0.001".

Each -99 record ends the repeat pattern specified by the entries above it.

Sequence in the file determines the line type number, beginning with Line Type 0.

The number of records in this file specifying lines or gaps (not including the -99 records) must not exceed 180.

Up to 18 line types can be specified (Line types 0-17).

You can customize your CONFIG9.PLT file to suit your purposes. The edit program must produce an ASCII file without non-printing characters and with no blank lines at the start or end of the file. Don't mess with the definition of Line Type 0.

Each record must end with a carriage return and line feed.

Annotations on the right side of the print are not a part of the file. Print and check the CONFIG9.PLT file supplied with Version 9 to review its exact format without the annotations printed above..

## PLOTTER INFORMATION

### ROTATION

Rotation is a plotter feature enabling rotation of a plot by 90 degrees on the plotter media. Check the plotter manual for rotation instructions. In most cases if the X dimension of the plot exceeds the Y, no "rotation" should be specified.

### SPEED AND FORCE

Speed and force are plotter parameters. Pen speed is specified in centimeters per second, force by integers 1 to 8. Optimum speed and force depend on pen type and plot media. Default settings provided by Hewlett-Packard are given here in parentheses. The quality of final plots is generally improved by reducing the pen speed.

| PEN TYPE            | SPEED cm/sec | FORCE values | Force values = grams |                    |
|---------------------|--------------|--------------|----------------------|--------------------|
|                     |              |              | 1 = 10 g             |                    |
| Fiber               | 25 (50)      | 1 (2)        | 2 = 18 g, 3 = 26 g   |                    |
| Roller              |              | 30 (60)      | 3 (6)                | 4 = 34 g, 5 = 42 g |
| Refillable ink pens | 12 (30)      | 2 (2)        | 6 = 50 g, 7 = 58 g   |                    |
| Disposable ink pens | 15 (15)      | 1 (1)        | 8 = 60 g             |                    |

### SCALING POINTS P1 and P2

If a plot is sent to a plotter, values for scaling points are provided to the computer by the plotter. Entry of scaling Points is required if plots are sent to a file rather than to a plotter. Scaling points P1 and P2 are discussed in the documentation for each plotter. The values of scaling points depend on the kind of plotter and on the size of the plot paper. Values for two plotters are provided below. Paper dimensions are in inches. Scaling points are the coordinates of the lower left and upper right corner of the sheet in plotter units (1/1024"). Examples are provided below:

For the HP 7475A

|                         | P1x,P1y | P2x,P2y     |
|-------------------------|---------|-------------|
| A size paper 8 1/2 x 11 | 250,596 | 10250,7796  |
| B size paper 11 x 17    | 522,259 | 15722,10259 |

For the HP 7550A

|                         | P1x,P1y | P2x,P2y     |
|-------------------------|---------|-------------|
| A size paper 8 1/2 x 11 | 80,320  | 10080,7520  |
| B size paper 11 x 17    | 620,80  | 15820,10080 |

ROTATED

| P1x,P1y | P2x,P2y     |
|---------|-------------|
| 320,80  | 7520,10080  |
| 80,620  | 10080,15820 |

For the HP 7585/7586

|                          | P1x,P1y       | P2x,P2y     |
|--------------------------|---------------|-------------|
| A size paper (8 1/2 x 11 | -2790,-4500   | 2790,4500   |
| B size paper 11 x 17     | -7100,-4500   | 7100,4500   |
| C size paper 17 x 22     | -7090,-10075  | 7090,10075  |
| D size paper 22 x 34     | -15710,-10060 | 15710,10060 |
| E size paper 34 x 44     | -20840,-16180 | 20840,16180 |

## SCREEN

The CONFIG9.SCR file is very simple. It contains one line that indicates the type of graphic adaptor installed in your computer and the type of monitor attached to the graphic adaptor.

### CONFIG9.SCR

The CONFIG9.SCR file must be configured to match the adapter and monitor of the system. Colors for EGA and VGA systems are set according to the number of the pen chosen for the code in the plot control file.



For CGA color or monochrome the file consists of one line:

"CGAC"

For EGA color or monochrome the file consists of one line:

"EGAC"

For VGA color or monochrome the file consists of a one line:

"VGAC"

Colors displayed on color EGA and VGA systems will be controlled by the pen number in the plot control file, and drawn as in the list below:

Pen #1=Blue

Pen #2=Green

Pen #3=Cyan

Pen #4=Red

Pen #5=Magenta

Pen #6=Brown

Pen #7=White

Pen #8=Gray

Pen #9=Light Blue

Pen #10=Light Green

Pen #11=Light Cyan

Pen #12=Light Red

Pen #13=Light Magenta

Pen #14=Yellow

Pen #15=High Intensity White

If a code is used, but the pen= color for this code is not specified in the plot control file, the default color is #14=Yellow. Color #15=High intensity white is used in the edit procedure to indicate the entry chosen for editing.

The file supplied on the release disks named CONFIG9.EGA is a sample file that can be used with an EGA color system by renaming it CONFIG9.SCR.

You should modify the CONFIG9.SCR file to set one of the above values in the first and only line of the file. DO NOT forget the carriage return after the second double quote!

## SOURCE CODE

Version 9.0 of GSMAP and related programs were written and tested using the Microsoft QuickBasic Compiler Version 4.0b. The mouse routines were derived from the documentation and library of the Mouse Programmers Reference, 2nd. edition, 1991, Microsoft Press. This library is required for recompilation of the programs that use the mouse. The program cannot be tested or executed under BASICA, but must be compiled.

Van den Grinten Projection:  
Projection #9

Not defined at Latitudes 90 N or 90 S. Trim data files so that there is no data at either geodetic pole (yes, GSMAP will look, then crash).

PLOT CONTROL FILE FOR WORLD CENTERED AT 0 DEGREES LONGITUDE

N Put plot corners into file  
80,0,0,N,180,0,0,W  
0,0,0,N,180,0,0,W  
0,0,0,S,180,0,0,E  
80,0,0,N,180,0,0,E  
78890000,78890000  
0,0  
N  
N  
12,2  
0.04,0.06  
90,1,0,0, "grid"  
0,0,0,0, "END OF PLOT FILE"

VAN DEN GRINTEN PROJECTION FILE  
VDG0.PRJ

9  
6378.2064  
6356.5838  
0,0,0,W

GRID GENERATED USING GSMUTIL

80 N 180 W  
80 S 180 E

10 degree spacing

Make sure that the equatorial radius is equal to or greater than the polar radius or GSMAP will start a slow search of the universe for the unique planet you are working on and not return in your lifetime.

Don't attempt to digitize or plot more than 180 degrees of longitude either east or west of the principal meridian used in the projection file.

## 10 STEREOGRAPHIC

10

6748.2064 RADIUS OF SPHERE

6748.2064 RADIUS OF SPHERE

90,0,0,N LAT OF CENTER

90,0,0,W LONG OF CENTER

100,0,0,W

GRID

180,0,0,W 180,0,0,E

0,0,0,N 75,0,0,N @ 15 degrees

PLOT FILE

N

0,0,0,N,280,0,0,W

0,0,0,N,190,0,0,W

0,0,0,N,100,0,0,W

0,0,0,N,10,0,0,W

100000000,100000000

0,0

N

Y

12,2

1,8,0,0,

21,14,0,0, OUTLINE COASTLINE

22,14,4,0, STATE BOUNDARIES

23,14,6,0, INTERNATIONAL

24,0,0,14,4,0, STATE BOUNDARIES RIVERS

0,0,0,0,

## 11 ORTHOGRAPHIC

11

RADIUS OF SPHERE

RADIUS OF SPHERE

LAT OF CENTER

LONG OF CENTER

## 12 AZIMUTHAL EQUIDISTANT

12

RADIUS OF SPHERE

RADIUS OF SPHERE

LAT OF CENTER

LONG OF CENTER

## 13 LAMBERT AZIMUTHAL EQUAL AREA

13

EQUATORIAL RADIUS

POLAR RADIUS

Latitude of Center

Longitude of Center

#### Acknowledgments

We extend thanks to the users of GSMAP who have worked with us, some over a five year span, providing comments, suggestions, and problems. Gold stars to special individuals for their help, including G. R. Allcott whose continuing interest made GSMAP possible, E. A. du Bray, G. N. Green, B. R. Johnson for hardware design, Version 1.0, M. R. Mall, J. C. Reid (North Carolina Geological Survey), G. E. Ulrich, W. Thoen for help with the Hershey Fonts, Version 6.0, F. H. Wilson for special assistance with color graphics, Version 4.0, C. L. Smith, Version 1 of GSDIG and GSPOST, and to the unsung heroes who serve as the reviewers of these Open File Reports and thereby earn their places in Walhalla. Steven M. Smith deserves special mention for his role in developing and testing the GSMPBS program, Craig Selner for his design of the cursor used with the mouse.

For the first three months of the existence of GSDRAW and GSMAP these programs were in use on two computers supported by one digitizer and one plotter. At that time we had a complete list of all two users of these programs. The last time we were asked how many used these programs (by the director of the U. S. Geological Survey) our answer had to be an unequivocal ???!! To help us answer this question we ask a moment of your time. If you would, please, copy the form below, answer some or all of the questions, and mail it back to us. Don't send the original so's those who copy your documentation will also copy this form. We'll never know about all users ... only those who read the documentation far enough to see this note and reply. See advice on \*documentation in the Glossary. This ain't registration. We promise to read all comments, consider suggestions, and then do as we deem best about incorporating changes into Version 10 if there ever is a Version 10.

.....

User's Name(s):

\_\_\_\_\_  
Organization \_\_,Unorganized \_\_:

\_\_\_\_\_  
Whereabouts:

\_\_\_\_\_  
Source of the copy:

Paid cash to the Open File Services Section:

\_\_\_\_\_  
Paid cash somewhere else:

\_\_\_\_\_  
Copied it from a friend \_\_,Enemy \_\_,Bulletin board \_\_:

\_\_\_\_\_  
Gift \_\_,free list \_\_:

\_\_\_\_\_  
Comments on programs of System 9.0:

Polite:

Others:

Comments on the mouse:

New features/programs needed:

.....  
Please return a copy of the above to one of the authors, U.S. Geological Survey, Denver Federal Center, M.S. 905, Lakewood, Colorado, 80225. We thank you for your support and wish you well with System 9.

\_\_\_\_\_

## Notes

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## INTRODUCTION TO GSREF

### Basic Information

#### Purpose of GSREF

The GSREF program has been developed to organize, store, and retrieve bibliographic citations. The program allows the user to store a bibliographical citation with keywords that allow the citation to be recalled later by content (including author), keyword(s) or reference number. If references are filed by reference number, GSREF provides a quick, convenient filing system. The citations are always retrieved in an alphabetic sequence and can be printed or stored in a publication style text file for direct inclusion in a report prepared using a word processing system.

#### System requirements

To use GSREF you need a computer that uses the DOS disk operating system, and has at least 512 Kbyte of memory, at least one disk drive, and a printer connected to LPT1: (parallel port #1). You should have a working familiarity with the use of the computer and DOS; if you are not sure about operating the computer, seek the advice of someone more experienced.

#### Menus

GSREF makes use of two menus: a Main Menu and a Data Management Menu. Choices from the Main Menu mainly provide retrieval functions; those from the Data Management Menu provide other functions related to the data base. The user chooses a function by typing the number that appears to the left of the desired function utilizing the keys at the top of the keyboard, followed by a carriage return (hit the ENTER key). The program then can execute the selected function.

#### GSREF data base files

A GSREF data base consists of three DOS files: an Index File, a Keyword File and a Data File. The user supplies the name of the data base and the GSREF supplies appropriate extensions for each of the files. The data base name must follow DOS conventions for the name of a file.

##### Index file

The Index File has the extension NDX. The file is used to maintain the alphabetical sequence of entries, locate text within the Main Data File and record the number and value of keywords for each citation.

##### Keyword file

The Keyword File has the extension KEY. The file is used to contain all of the keyword values that have been entered. It is used to check for errors in keyword entry and in retrieval by keyword.

##### Main data file

The main data File has the extension REF. The file contains the text that makes up a citation. The file is searched during retrieval by text in content, and is the source of the records for a citation that are displayed when using all retrieval options.

#### Getting acquainted with GSREF

The best way to become familiar with the use of GSREF is to read this manual, then use the program to enter a few references and try out its features with this small data base. You are strongly encouraged NOT to spend hours entering references until you are thoroughly familiar with what GSREF can do and just as importantly what it can not do! Copy the file GSREF.EXE from the release disk to a working copy. No other files are required. In this document, the term "ENTER" means type the response to a prompt followed by hitting the ENTER key (also called the RETURN KEY).

#### GSREF Version 4.0

Version 4.0 of GSREF has been written in Microsoft QuickBasic. This version of GSREF succeeds Version 3.1 which was written in Fortran. Both are loosely based on previous work done by Selner, Gettings and North (1981) while part of the U.S. Geological Survey-Saudi Arabian Mission. The GSREF program is in the public domain and can be freely copied and provided to others.

## OPERATION OF GSREF

To start the program enter **GSREF**. After brief display of the disclaimer screen the Main Menu will be displayed. Or if you wish to start the program and immediately open an existing data base, enter **GSREF** followed by a blank space and the name of the data base, e.g. **GSREF COLORADO**. If this is done information on the contents of the data base will be displayed on the screen. The Main Menu screen appears as shown below. After a data base has been opened, the name of the data base will appear on the screen, under the words **CURRENT DATA BASE**. Operations must start either with Option 1, **OPEN A NEW DATA BASE** or with Option 2, **OPEN AN EXISTING DATA BASE**. The name of a data base is specified by entering the name of the data base; the DOS extensions of the various files are not entered.

#### Main Menu

|                 |  |
|-----------------|--|
| G S R E F       |  |
| M A I N M E N U |  |

|                                   |                    |
|-----------------------------------|--------------------|
| 1 - START A NEW DATA BASE         | CURRENT DATA BASE: |
| 2 - OPEN AN EXISTING DATA BASE    |                    |
| 3 - CHANGE DEVICE/STYLE OF OUTPUT |                    |
| 4 - BROWSE THE CURRENT DATA BASE  |                    |
| 5 - RETRIEVE BY REFERENCE NUMBER  |                    |
| 6 - RETRIEVE BY KEYWORD           |                    |
| 7 - RETRIEVE BY CONTEXT           |                    |
| *8 - DATA MANAGEMENT MENU         |                    |
| 9 - EXIT                          |                    |
| ENTER CHOICE: ?                   |                    |

The default option (hit ENTER key is indicated by the asterisk on the display, and is option 8, change to the DATA MANAGEMENT MENU.

#### Option 1, START A NEW DATA BASE

Enter the name to be used for the new data base. The name must follow DOS conventions for file names (eight characters or less, no periods, and no distinction between upper and lower case characters). Extensions for the three files forming the data base will be supplied by the program. After this entry operations will return to the Main Menu.

#### Option 2, OPEN AN EXISTING DATA BASE

Enter the name of the data base. Do not enter an extension. After entry of the data base name a message will be displayed in the format below:

THERE ARE 343 REFERENCES IN CURRENT DATA BASE  
THERE ARE 17 KEYWORDS  
HIT RETURN TO CONTINUE.

Deleted references are counted in the count of references. Deleting a reference does not save space in the data file, but deleted references will not be included in output from the program. Hit the ENTER key, and operations will return to the Main Menu.



### Option 3, CHANGE DEVICE/STYLE OF OUTPUT.

Option 3 is used to direct output to the screen, to a printer connected to LPT1: (parallel port #1) or to a file with a name chosen by the user, and to select either a publication style format or a data base style format providing the number of the reference and the keywords as well as the reference. The default at the start of a session in GSREF is output to the screen in data base style.

After selecting option 3 the choices are the following as indicated by the prompts:

- 1 - SCREEN OUTPUT
  - 2 - PRINTER OUTPUT
  - 3 - DISK FILE OUTPUT
- ENTER CHOICE: ?

Enter the number of the desired choice, 1, 2, or 3.

Selection of 3 will call another prompt:

ENTER FILENAME: ? calls for entry of the name of the file to be used to store the output reference list.  
Enter the full name (including extension of the file to be used for data storage.

After selection of the output device prompts will call for selection of the style of output. The prompts will be:

- 1 - PUBLICATION STYLE OUTPUT
  - 2 - DATA BASE STYLE OUTPUT(INCLUDES REF#)
- ENTER CHOICE: ?
- Enter 1 or 2

Example of output format #1, Publication style.

Olson, J.C., 1974, Geologic map of the Rudolph Hill quadrangle,  
Gunnison, Hinsdale, and Saguache Counties, Colorado: U.S.  
Geological Survey Geologic Quadrangle Map GQ-1177. \

Example of output format #2, Data base style.

REFERENCE NUMBER 22 CONTAINS 3 LINES OF TEXT 4 KEYWORDS  
Bromfield, C.S., 1967, Geology of the Mount Wilson quadrangle,  
western San Juan Mountains, Colorado: U.S. Geological Survey  
Bulletin 1227, 100 p. \  
CO Au 24000 IG

The character \ at the end of each reference is present because this data base was created from a text file written using a word processing program using the character \ (ASCII=92) to mark the end of each reference.

### Option 4, BROWSE THE CURRENT DATA BASE.

This option permits easy inspection of the data base, and if desired, output of selected references. The response to the first prompt selects the starting point in the file for the start of the browse session using the first two letters on the first line of the reference (usually the first author's last name). From this point records can be examined in alphabetical sequence, either forward or backward in the file.

ENTER TWO ALPHABETIC CHARACTERS FOR STARTING POSITION  
AA-ZZ (OR RETURN TO START AT BEGINNING): ?

Enter the required characters, or hit the RETURN KEY to start the session at the first reference in alphabetical sequence order. The program will begin at the chosen entry point, display the reference on the screen and below it the prompt:  
SEND TO OUTPUT (Y/N\*): ?

If you enter Y the reference will be sent to the output (the default set when opening the program is to type the reference on the screen in data base format (keywords and reference number displayed) (the output device and format can be changed using Option 8). The next prompt will ask:

INDICATE DIRECTION (B=BACK,F\*=FORWARD,Q=QUIT): ?

Enter B to browse in reverse alphabetical sequence, enter F or use the Enter key to browse in alphabetical sequence. Enter Q to return to the Main Menu.

#### Option 5, RETRIEVE BY REFERENCE NUMBER

Prompt for Option, ENTER REFERENCE NUMBER (TO EXIT ENTER 0):

The selected reference will be displayed on the screen. Hitting the RETURN key at the prompt HIT RETURN TO CONTINUE, Q TO QUIT will continue this retrieval until entry of Q or 0 returns operations to the Main Menu. If Option 8, CHANGE DEVICE/STYLE OF OUTPUT has been used to change the default screen output to output to a file, references will be sent directly to the file without screen display.

#### Options 6 and 7, RETRIEVE BY KEYWORD, and RETRIEVE BY CONTEXT

These options for data retrieval enable retrieval of references for inspection and output. Keywords form the basis for retrieval using option 5, words in the reference citation using option 6. The means of requesting retrieval is the same for both options.

TESTS ARE SPECIFIED BY TYPING A PREFIX (FOR OR NOT) FOLLOWED BY A COMMA, THEN A TEST VALUE(KEYWORD OR TEXT) FOLLOWED BY A COMMA, THEN A CONNECTOR (AND or OR) FOLLOWED BY ENTER KEY IF VALUE CONTAINS A COMMA ENCLOSE THE VALUE IN DOUBLE QUOTES OMIT CONNECTOR ON LAST LINE.  
EXAMPLE: FOR,"Selner, G. I." AND  
FOR, "Taylor, R. B.",

ENTER TEST CONDITIONS (PREFIX, VALUE, CONNECTOR)  
ENTER QUIT,, TO EXIT

The VALUE requested above is a keyword for option 6, a character, word, phrase, or other group of characters for Option 7. Up to 12 lines can be used to specify selection criteria. Keywords and text are case-sensitive.

#### Option 8, DATA BASE MANAGEMENT MENU

This option shifts operation to the DATA BASE MANAGEMENT MENU  
Enter 8 or hit the ENTER key.

#### Option 9, EXIT

This option returns operations to the DOS prompt. Enter 9.

## Text editor

The text editor is used under Options 1 (ADD AN ENTRY) and 4 (EDIT AN ENTRY) from the Data Management Menu. The character ^ is used below to indicate the use of the (control) key. For example, ^G (to delete a character, means hold the control key down, then press the G key, either lower case or upper case. A help screen reached by using the F1 key summarizes most of the available functions.

### Help screen

#### EDITING COMMANDS-

##### -CURSOR MOVEMENT

^S = char. left  
^D = char. right  
^A = word left  
^F = word right  
^E = line up  
^X = line down

##### -DELETE

^G = char  
Del = char. left  
^T = word right  
^Y = line

##### -OTHER-

^N = insert line  
^V = INSERT on/off  
^B = reformat  
HOME = beginning of line  
END = end of line  
^R = get text of an entry

##### -ALTERNATE KEYS-

← = char. left  
→ = char. right  
↑ = line up  
↓ = line down

INSERT = insert on/off  
ENTER = insert line

HIT ANY KEY TO CONTINUE

#### Delete:

^G Delete the character at the cursor  
DEL = delete the character to the left of the cursor  
^T Delete the word to the right of the cursor  
^Y Delete the line marked by the cursor

#### Cursor movement:

The → key or ^D moves the cursor one character to the right  
The ← key or ^S moves the cursor one character to the left  
The ↑ key or ^E moves the cursor up one line  
The ↓ key or ^X moves the cursor down one line  
^A or ^← moves the cursor one word left  
^F or ^→ moves the cursor one word right  
Home moves the cursor to the beginning of a line  
End moves the cursor to the end of a line

#### Other:

^N is used to insert a line.  
^B is used to reformat text from the line the cursor is on through the end of the reference. The line length is set at 72 characters.  
^R is used to read the contents of a previous reference and copy it into the current reference. A prompt will ask for the number of the reference to be copied.

The editor opens in insert mode. The Ins (insert) key or ^V can be used to toggle between insert and overwrite modes. The insert mode cursor \_ changes to a blinking █ in overwrite mode.

## Rules of the road for data input

A reference citation can contain 1-20 lines.

A single reference citation can have 0-12 key words.

A data base can have 0-1000 key words.

Examples of the two file formats for data input are provided below:

Example of format #1.

Obradovich, J.D., 1982, NDS 157; Albion, K-Ar/biotite-bentonite, Middle West North American Basin, in Odin, G.S., ed., Numerical dating in stratigraphy: John Wiley & Sons, p. 838-839. \

Example of format #2

REFERENCE NUMBER 1636 CONTAINS 3 LINES OF TEXT 8 KEYWORDS

Obradovich, J.D., 1982, NDS 157; Albion, K-Ar/biotite-bentonite, Middle West North American Basin, in Odin, G.S., ed., Numerical dating in stratigraphy: John Wiley & Sons, p. 838-839.

chron geol mz sw K bent  
Ar mica

## Data Management Menu

|                                     |
|-------------------------------------|
| G S R E F                           |
| D A T A M A N A G E M E N T M E N U |

### CURRENT DATA BASE:

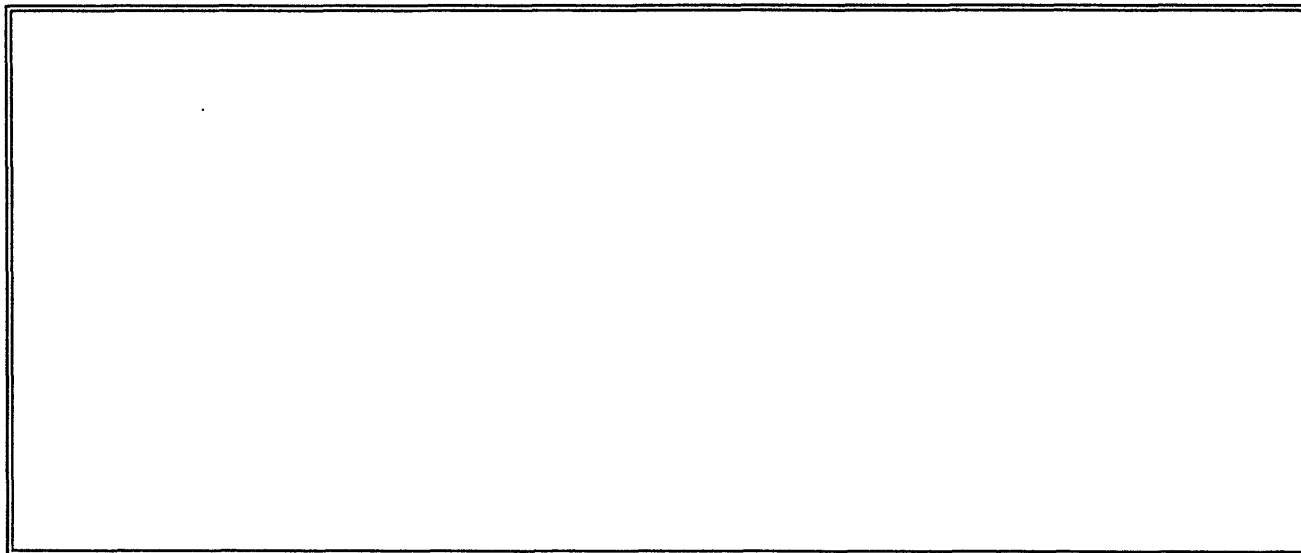
- 1 - ADD AN ENTRY
- 2 - ADD A KEYWORD
- 3 - DELETE AN ENTRY
- 4 - EDIT AN ENTRY
- 5 - IMPORT A FILE CREATED BY A TEXT PROCESSOR
- 6 - LIST KEYWORDS (SORTED)
- 7 - EXPORT DATA BASE TO ASCII FILE
- 8 - IMPORT A SORTED ASCII FILE
- 9\*- RETURN TO MAIN MENU

ENTER CHOICE:?

The default option (hit ENTER key) is indicated by the asterisk on the display, and is option 9, change to the Main Menu.

### Option 1, ADD AN ENTRY

Selection of option 1 provides a screen used for data entry so that a reference can be added to the data base. Use the text editor to enter the desired reference in standard format. After entry of the citation, save the reference in the data base by using the F10 key.



F1 KEY FOR HELP      F9 TO EXIT wo/saving      F10 TO EXIT AND FILE

Prompts will then call for entry of keywords, ending when the ENTER key is used instead of entering another keyword.

If the keyword is not contained in the existing keyword file a prompt will ask, IS THIS A NEW KEYWORD?(Y/N\*):

If you wish to add the word to the keyword file, enter Y then enter the keyword, and proceed. Hitting the ENTER key in response to the ENTER KEYWORD prompt will return operation to the Data Management Menu.

### Option 2, ADD A KEYWORD

Use this option to add a keyword to the list in the keyword file. A data base can have as many as 1,000 keywords. A keyword can have as many as 12 characters. Keywords are case sensitive.

The prompts are:

ENTER NEW KEYWORD: Respond by entering the a new keyword.

OK?(Y\*/N) Confirm by entering Y or striking the ENTER key.

ADD ANOTHER(Y\*/N) To add another enter Y or hit the ENTER key. To return to the Data Management Menu enter N.

### Option 3, DELETE AN ENTRY

Use Option 3 to delete a reference from the database. After selecting option 3, the prompt ENTER REF. NUMBER TO BE DELETED (0 TO EXIT): ? calls for entry of the number of the reference to be deleted. After entry of the number of the reference to be deleted, opportunity is provided to delete another reference:

DELETE ANOTHER (Y\*/N)? Enter Y or hit the ENTER key to continue, or enter N to return to the Data Management Menu.

#### Option 4, EDIT AN ENTRY

Use this option, to edit a reference and to modify keywords for a reference. A prompt will call for entry of the Reference number to be edited.

**ENTER REF. NUMBER TO EDIT (0) TO EXIT:** After the number of the reference is entered the screen will have the configuration shown below, with the citation displayed inside an area defined by the double lines, as shown in this example.

```
Adams, J.H., Gude, A.J., and Beroni, E.P., 1953 (1954), Uranium
occurrences in the Golden Gate Canyon and Ralston Creek areas,
Jefferson County, Colorado: U.S. Geological Survey Circular 320,
16 p. \
```

F1 KEY FOR HELP    F9 TO EXIT wo/saving    F10 TO EXIT AND FILE

Changes are made to the citation using the text editor. When revisions have been completed, and the display on the screen checked, the F10 key is used to record the changed reference in the data base. After the reference has been saved, the existing keywords for the reference will be displayed on the screen along with the prompt **DO YOU WANT TO CHANGE KEYWORDS (Y/N\*)?** A Y response provides opportunity to re-enter keywords (the default is N). Entry of Y provides a list of the existing key words, and a prompt **ENTER KEYWORD:**

Enter each of the keywords for the reference in turn. If the keyword is not contained in the existing keyword file a prompt will ask, **IS THIS A NEW KEYWORD?(Y/N\*):**

If you wish to add the word to the keyword file, enter N enter the keyword, and proceed.

Hitting the ENTER key in response to the ENTER KEYWORD prompt returns operation to the Data Management Menu.

## Option 5, IMPORT A FILE CREATED BY A TEXT PROCESSOR

The text file used for data entry USING OPTION 5. must have two characteristics:

1. Each line must end with a carriage return except for document mode wordstar file.
2. Each bibliographic citation must be ended with a unique ASCII character that marks the end of the last line of the citation. This character must be immediately prior to the carriage return of the last line of the reference (an example might be ASCII character (92= \).

Some word processing programs such as Volkswriter create text files that are directly compatible. Volkswriter uses an ASCII character (020=¶) as a paragraph marker (to mark the end of a citation). Files created in document mode Wordstar can be used directly by inserting a \ character (ASCII 092) at the end of each citation (in this single case rule #1 above does not apply).

During data import references will be alphabetized, lines of text will be reformatted to 72 character length. Prompts will be:

ENTER FILENAME: Enter the complete name of the file containing the text (including extension).

ENTER STYLE OF INPUT (1 OR 2):

### Example of Style #1

Obradovich, J.D., 1982, NDS 157; Albion, K-Ar/biotite-bentonite, Middle West North American Basin, in Odin, G.S., ed., Numerical dating in stratigraphy: John Wiley & Sons, p. 838-839. \

### Example of Style #2

REFERENCE NUMBER 1636 CONTAINS 3 LINES OF TEXT 8 KEYWORDS  
Obradovich, J.D., 1982, NDS 157; Albion, K-Ar/biotite-bentonite, Middle West North American Basin, in Odin, G.S., ed., Numerical dating in stratigraphy: John Wiley & Sons, p. 838-839.

|       |      |    |    |   |      |
|-------|------|----|----|---|------|
| chron | geol | mz | sw | K | bent |
| Ar    | mica |    |    |   |      |

If Style #1, a prompt will request:

ENTER ASCII CODE INDICATING END OF ENTRY

Example: if the character \ = ASCII 92 has been used to mark the end of each reference, enter 92.

After this entry, a prompt will request entry:

WAS THIS FILE CREATED BY WORDSTAR? (Y/N\*) : If the file was created using document mode Wordstar, answer Y, otherwise answer N. The next prompt asks about keyword entry (from the keyboard during the reading of the input file).

DO YOU WANT TO ENTER KEYWORDS NOW? (Y/N):

If you enter N the program will run and create the data base requested.

If you enter Y the program will start, but pause at the end of the first reference (marked by the chosen ASCII character), request entry of the key word(s) for the entry, then after appropriate entries to prompts ENTER KEYWORD, and a final response using the ENTER key, go on to succeeding entries until the ASCII file has been converted into a GSREF data base.

If Style #2, the program will run, create the data base, then return operations to the Data Management Menu.

Input from the file is added to the current data base.

## Option 6, LIST KEYWORDS (SORTED)

Entry of 6 provides a list of keywords sorted in alphabetical order on the screen.

#### Option 7, EXPORT DATA BASE TO ASCII FILE

Use Option 7 from the Data Management Menu used to create an ASCII file from an entire data base. Such a file can be edited using the word processing program of choice for inclusion in a manuscript, or for return after editing to GSREF using one of the import data options. Deleted entries are not copied from the GSREF data base to the output ASCII file.

Prompts are similar those of Option 3 from the Main Menu; descriptions of entries are provided in a previous section.

ENTER OUTPUT FILENAME: ?

1 - PUBLICATION STYLE OUTPUT

2 - DATA BASE STYLE OUTPUT(INCLUDES REF# AND KEYWORDS)

ENTER CHOICE:?

ENTER SEQUENCE FOR OUTPUT

1=REF.NUMBER

2=ALPHABETIC

ENTER CHOICE ?

Choice #1 sends references to the file in the sequence entered in the file, #2 sends references to the file in alphabetical sequence.

#### Option 8, IMPORT A SORTED ASCII FILE

Use Option 8 from the Data Management Menu to import an ASCII file like that generated from a GSREF data base using the DATA BASE STYLE OUTPUT (type #2, using Option 8 from the Main Menu). Such a file (an example of the format is provided on p. 9) produces a data base with references in the sequence of the ASCII file, complete with the listed keywords.

The alphabetic sequence of references is not checked during creation of the GSREF data base. Like Option 5, keywords are read from the ASCII file.

#### Option 9, RETURN TO MAIN MENU

Entry of 9 or hitting the ENTER key returns operation to the Main Menu.



## QUESTIONS ABOUT USING GSREF

### How do I put data into a GSREF data base?

The most direct way to put data into a GSREF Data Base is to choose the first option Add an Entry from the Data Management Menu by typing a 1 followed by a carriage return. The program will request the data. You can enter less than the maximum number of 72 characters per line. When the citation is complete use the F10 key to record the citation in the data base.

As you respond to the questions for keywords, the program will check the value you type against the list of keywords previously designated for this data base. Those keywords it recognizes actuate a request for another keyword. Keywords that have not been used before will generate a question that asks if this is a new keyword value. The program has checked the value you typed against the current keyword list and it did not find a match. If you made a typing mistake, simply reply N followed by a carriage return; if it is a new value that should be entered on the list, respond with Y and a carriage return.

### How do I use a file that I created using a word processing program ?

Create the text file in standard format. End each line with a carriage return and end each reference with a special character like \ that isn't used in the citation. Start the GSREF program, start a data base by using Option 1, Main Menu (type a 1 followed by the ENTER key, and follow prompts requesting the name of the data base. Change to the Data Base Management Menu by hitting the ENTER key, then invoke Option 5 Import a Text File by typing a 5 followed by the ENTER key. The program will request the filename of the text file. Enter the name and a carriage return. The program will then request the style of the input data. Type a 1 followed by a carriage return. The program will then request the ASCII value of the character marking the end of each reference. Volkswriter creates a file with paragraphs ended by the character ASCII 020=¶ and a carriage return. A prompt will ask if the file is a WORDSTAR file. If it was made using document mode WORDSTAR answer Y, if not enter N or hit the ENTER key. The program will then ask if you wish to enter keywords for each citation as they are read in and filed. Respond as you choose. If you say no (N), the program will proceed to file each of the citations with no further intervention. If you respond yes (Y), the program will allow you to enter up to twelve keywords for each citation and then file the citation. Operation will revert to the Data Management Menu when all of the citations have been added to the data base. For ASCII files such as those created using non-document mode WORDSTAR, end each reference with a character such as \=ASCII 92. For files created using other word processing programs, use text editing features in the file to make sure that each line ends with a carriage return and each reference with a special character.

### But I use brand XYZ, and I don't know its file format, now what?

Many word processing programs provide for file conversion to ASCII or WORDSTAR format either as a part of the main program or as a utility program provided with the release, and there are commercially available programs that convert between many different word processing programs. We suggest that in case of doubt you convert files created in a different word processing program either to WORDSTAR or to ASCII format depending on your preference, then follow the rules for the corresponding data files. We don't know the file format for Brand XYZ either, but we'll bet a cup of coffee that the Brand XYZ folks can advise you how to convert the files to ASCII format for the price of a phone call.

### When should I enter keywords?

Option 2 of the Data Base Management Menu allows you to enter new keyword values into the keyword file. You may prefer to enter all of the possible values into the keyword list prior to entering any citations. This will allow you to always regard the question of mismatching as a possible typographical error on input. When all of the keywords have been entered for a new reference, simply enter a carriage return to indicate the end of data for the keyword field.

The best method of retrieving data will vary with the circumstances; the program attempts to allow you maximum flexibility in that you can simply browse, you can be very specific (reference number) or you can use logic based on your knowledge of the subject matter stored in the data base to make sure that you get exactly those entries that you want. We strongly recommended that you spend some time simply playing with a small sample data base that contains a few entries and attempt the various types of retrieval to make sure that the data you enter in your final data base has the proper content and structure to permit you to retrieve it as anticipated. Retrieval by keyword and text in content utilize a process of specifying a selection criteria that involves one or more lines each containing three elements: a prefix, a test value and a connector separated by commas. The prefix has two possible values FOR to indicate a true test against the test value and NOT to indicate a false test against the test value. The test value is a string of characters separated by commas. It can consist of up to 12 characters for a keyword retrieval and up to 24 characters for a text in content retrieval. If the string has a comma in it enclose the string between " (double quote) characters. The connector element allows you to connect lines logically. The values can be AND and OR. The AND connector means that the current line and the next line must both be true for a citation to be retrieved. The OR connector means that the current line (and possible other previous lines if AND was used previously) and the following line are independent and either being true will result in a citation being selected. The connector must be omitted on the last line since there will not be a succeeding line. Generally most retrievals can be done with a one or two line set of specifications; however, you can use up to 45 lines to specify the criteria. You must enter a final carriage return to signify that all of the criteria has been entered. The program will then display the criteria on the screen and request that you confirm that it is correct. Keep in mind that AND joins criteria and both must be true; OR separates the criteria and either can be true. If you are using the screen as the output device, GSREF will pause between retrieved entries to allow you time to read the citation and when you wish to proceed with the search, you must enter a carriage return to allow the program to continue the search. When you are through with the search enter a Q followed by a carriage return to return to the Main Menu.

#### Retrieval by browsing

The simplest way to retrieve data from a GSREF Data Base is to choose the BROWSE DATA BASE option from the Main Menu. This option allows you to browse through citations in the data base alphabetically. Each citation is brought to the screen first and then you can route it to the current output device in the current style of output. If you do not wish to send the citation to the output device, simply enter a carriage return. You are then asked whether you wish to move forward, backward or quit. If you wish to move forward, simply depress the carriage return (or type an F and a carriage return). To go backwards to the previous citation, enter a B and a carriage return. Assuming that you are not at the beginning or end of the data base (you cannot go past either end), the next citation will appear on the screen and you again start making choices about output, etc. To return to the Main Menu enter a Q in response to the direction question.

#### Retrieval by reference number

GSREF assigns a number to each citation as it is entered in the data base. If you remember the numbers of the entries, you can retrieve them by selecting the RETRIEVE BY REFERENCE NUMBER option from the Main Menu. You are then requested to enter an integer number followed by a carriage return. The citation will then appear on the screen and you can route it to the output device as in the browsing option (see above). When you have seen all the entries that you wish to examine, enter a carriage return (or a zero and a carriage return) to return to the Main Menu.

### Retrieval by keyword

From the Main Menu you choose RETRIEVE BY KEYWORD by typing a 6 followed by a carriage return. You are then prompted by an example line that illustrates the format of each line of selection criteria to be entered. You should now enter the test criteria, line by line, ending each line with a carriage return. On the last line hit the ENTER key instead of typing a connector. The program will then display the search criteria on the screen. It reformats lines containing the connector OR so that the logic is more obvious. The program then asks you to verify that the criteria are correct. If so, depress the carriage return. If not, enter a N and a carriage return to restart search criteria input. When the entire file has been searched, the program returns to the Main Menu.

### Retrieval by content of text

From the Main Menu choose RETRIEVE BY CONTENT by typing a 7 followed by a carriage return. You are then prompted by an example line that illustrates the format of each line of selection criteria to be entered. You should now enter the test criteria, line by line, ending each line with a carriage return. On the final line depress the carriage return instead of entering a connector to signify that you have finished entry of the search criteria. The program will then display the search criteria on the screen. It reformats lines containing the connector OR so that the logic is more obvious. The program then asks you to verify that the criteria are correct. If so, depress the carriage return. If not, enter a N and a carriage return to restart specification of search criteria. When the entire file has been searched operations return to the Main Menu.

What are the choices for output devices and styles?

GSREF allows you a choice of output to the screen, to a printer, or to a file, and two different styles of formatting the information sent to the output device. Information is sent to the screen when starting the program (the screen is the default "device"). The two styles of output are a publication format that includes only the lines of text for a citation, and a data base style where the reference number and key words are also included. You have the option of changing the output device and style from the Main Menu. You simply type a 3 and a carriage return and the program will request that you identify the desired output device by choosing from a three option menu by entering a number (1, 2 or 3) and a carriage return. You will then be asked to choose one of the two styles of format by typing a number (1 or 2) and a carriage return. The program then returns to the Main Menu.

How can I annotate a reference so that I can recover a key quote when I need it?

Each reference can use up to twenty lines of text. Few require more than three or four. The remaining lines can be used for annotations, quotations, or whatever. If the citation proper is ended by a carriage return, and the following line of text is started with the two characters /\* (column 1 and 2) an annotation added to the reference field can be retrieved using the data base format but will be omitted from a listing in publication format.

If you want to create a GSREF Data Base using a subset of the citations that are a part of an existing GSREF Data Base or from parts of several GSREF data bases, the procedure is as follows:

1. Open the existing data base using Option 2 from the Main Menu.
2. Use Option 3 from the Main Menu to reset output to a file in the format desired.
3. Use Options 4, 5, 6, or 7 from the Main Menu to send the desired output to the file.
4. Repeat the steps above using other data bases if required.
5. Start a new data base using Option 1 from the Main Menu
6. Change to the Data Management Menu (hit the Enter key)
7. Use Option 5 to import the file or files created above.

How does one convert a GSREF data base made using GSREF Version 3.1 to a data base for Version 4.0?

Start with GSREF Version 3.1. Send the entire data base to an ASCII file, see documentation Version 3.1 p. 7. This is done by using Option 7 Change/Device/Style to specify output to an ASCII file, choosing sorted (alphabetized) output, then using Option 3 to export the entire file.

This ASCII file is used by the program REF3TO4.EXE included on the Version 4.0 release disk to create a Version 4.0 data base. Start this program by typing REF3TO4, then follow the prompts.

How does one delete deleted references so that they don't take up space in the file ?

Use option 7 from the Data Management Menu to create an ASCII file in data base format. This file will not include deleted references. Then create a new data base, Option 1 from the Main Menu. Then use Option 8 IMPORT A SORTED ASCII FILE, Data Management Menu, and import the sorted ASCII file into the new data base. The new data base will contain the contents of the old without the deleted references. The count of references will be reduced by the number of deleted references. The numbers of the references higher than the deleted reference(s) will be changed.

## REFERENCES

- Craig, J. C., 1988, Microsoft QuickBasic programmer's toolbox: Microsoft Press, 497 p.
- Covington, M. A., 1986, Smooth curves: PC Tech Journal, August, p. 110-120.
- Davis, J. C., 1973, Statistics and data analysis in geology: John Wiley and Sons, Inc., 550 p.
- Douglas, David H., and Peucker, Thomas K., 1973, Algorithms for the reduction of the number of points required to represent a digitized line or its caricature: The Canadian Cartographer, v. 10, no. 2, p. 112-122.
- Godson, R. H., Bracken, R. E., and Webring, M. W., 1988, PCCONTUR Version 1.0, a microcomputer general purpose contouring program: U.S. Geological Survey Open-File Report, 88-593A, 30 p.
- Godson, R. H., and Mall, M. R., 1989, potential-field geophysical programs for IBM compatible microcomputers, Version 1.0: U.S Geological Survey Open File Report 89-197A (documentation, 29 p.), 89-B-F, 7 diskettes.
- Newman, W.M., and Sproull, R.F., 1979, Principles of interactive computer graphics, second edition: McGraw-Hill, 541 p.

U.S. Geological Survey, 1986, Software documentation, General cartographic transformation package: U.S. Geological Survey, National mapping program, Technical Instructions, unpublished report, 68 p.

Selner, Gary I., 1986, User's guide for GSREF: a personal Computer Bibliographic system: U.S. Geological Survey Open File Report 86-0186, 15 p.

Selner, Gary I., Gettings, M.E., and North, B.M., 1981, REFBIB, a system for the storage and retrieval of bibliographic data: U.S. Geological Survey Open-File Report 81-0826; also 1981, U.S. Geological Survey Saudi Arabian Mission Miscellaneous Document 34, 78 p.

Smith, W. H. F., and Wessel, P., 1990, Gridding with continuous curvature splines in tension: *Geophysics*, v. 55 no. 3, p. 293-305.

Snyder, J. P., 1982, Map Projections used by the U.S. Geological Survey: U.S. Geological Survey Bulletin 1532 313 p.

Snyder, J. P., 1987, Map projections, a working manual: U.S. Geological Survey Professional Paper 1395, 393 p.

Snyder, J. P., 1988, Oral communication: Parameters for maps of Venezuela bearing the designation Proyeccion Conico Secante Compensada.

Snyder, J. P., 1990, The Robinson projection, a computation algorithm: *Cartography and geographic information systems*, v. 17, No. 4, pp. 301-305

Swain, C. J., 1976, A Fortran IV program for interpolating irregularly spaced data using the difference equations for minimum curvature: *Computers and Geoscience*, v. 1, p. 231-240.

U.S. Geological Survey, 1986, Software documentation, General cartographic transformation package: U.S. Geological Survey, National mapping program, Technical Instructions, unpublished report, 68 p.

Taylor, R. B., Selner, G. I., and Johnson, B. R., 1986, GS MRDS - a system based on the data fields used in the national MRDS system but using dBASE III and a microcomputer (IBM PC or compatible) for organizing data on mineral resource occurrences and providing tabular and graphical output: U. S. Geological Survey Open File Report 86-450 A, 69 p., and 86-450 B, one 360 Kbyte program diskette.

Watson, D. F. 1981, Aacord: automatic contouring of raw data: *Computers and Geosciences*, v. 8, no. 1, p. 97-101.

Wolcott, Norman M., and Hilsenrath, Joseph, 1976, A contribution to computer typesetting techniques: Tables of coordinates for Hershey's repertory of Occidental type fonts and graphic symbols: National Bureau of Standards Special Publication 424, 21 p.

Yates, S. R., 1987, Contur: a Fortran algorithm for two-dimensional high-quality contouring: *Computers and Geosciences*, v. 13, no. 1, p. 61-76.

## GLOSSARY FOR VERSION 9.0

### AGE

"The first year in existence." This definition from the "SDTS standards document p. 20, and they don't even have a glossary such as this as an excuse. The old Era, Period, Epoch, Age sequence has been slighted.

### AIR/LAND/WATER

"Existing in or part of the atmosphere, the Earth's dry surface, or a body of water." This definition from the "SDTS standards document p. 20. 'Guess we haven't yet superseded Earth, Air, Fire, and Water, just rephrased it.

### ASCII

Jargon used to baffle the neophyte; it's an abbreviation of American Standard Code for Information Interchange. The ASCII character set consists of control characters and graphic characters. When we use it here as an adjective to describe a plot control or projection file, we mean that the file uses the ASCII keyboard character set, which really is a set of numbers, between 33 and 127. ASCII characters in the extended character set 128-254 have special uses in text files (see section on Fonts). Font 99 has been created to put all of the special characters used for geologic age designations into the keyboard set so that there can be a direct conversion usable by much more powerful computer systems that can't use the extended character set (no Alt key).

### ASCII files

Many files needed for operation of these programs are ASCII files. The configuration files are ASCII files. Other ASCII files are used to control plotting, and when using geodetic coordinates to provide information needed by the computer to specify a map projection. These files are created by the user in advance of need using a word processing program (text editor). It works well to use the name of the data base with different extensions for related files. Our practice is to use .PRJ for projection parameter files, .PLT for plot control files, .RU for text files "Rock Unit" files for geologic maps, .SAM or .DAT for sample data. A consistent practice assists greatly in remembering what goes with what and helps avoid frustration. Yes, these programs could be written to require use of certain names for files; but we prefer to give you maximum flexibility so that you can best fit use of these programs to your needs.

### ASSUMPTIONS

Gridding and contouring programs make assumptions. The function to be gridded is single valued at all points in the region, the function is continuous within the region, and the function is positively autocorrelated over some length scale at least as large as the typical spacing between observation points (stolen from Smith and Wessel, 1990). Assumptions of normal or log-normal distribution are a part of many statistical algorithms. In plain language, if in doubt, don't.

### CODE

Code is a number specified in digitizing or plotting. Different codes have different functions, some are specific to a particular symbol, others can be used for lines, others for polygons, others for alphanumeric entries. Planning proper use of codes is essential to creating good maps. That's why codes are dictated in the Cartesian GSMAP exercise for each graphical element. We'll trust you from now on. Codes can be easily changed, either as a group, or for individual entries. Planning codes may be called scheming but should not be called plotting; that's something else.

### CODE GROUPS

Nine code groups are used, each with specific and different functions. Uses of these code groups are summarized below.

#### Code Group: Function

|         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1-99    | Lines, including lines decorated with symbols. Digitized points will be connected with straight line segments when line is plotted.                                                                                                                                                                                                                                                                                                                                                                  |
| 100-199 | Symbols and posting of associated data drawn from ASCII files.                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 200-299 | Individually rotatable symbols, such as strike and dip symbols. Each code is used for a specific symbol.                                                                                                                                                                                                                                                                                                                                                                                             |
| 300-399 | Other symbols individually sized by user.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 400-499 | Polygons, closed figures that can be patterned.                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 500-599 | Text. Alphanumeric characters drawn from ASCII files.<br>Multi-line entries.<br>Entries with leaders:, the first point digitized sets location of text, subsequent points define leaders.                                                                                                                                                                                                                                                                                                            |
| 600-699 | Splined lines.<br>Lines will be smoothed during plotting by a curve-fitting algorithm that honors all digitized points.                                                                                                                                                                                                                                                                                                                                                                              |
| 700-799 | Text. Alphanumeric characters drawn from ASCII files.<br>Single line entries only for each entry<br>No leaders<br>One point digitizing sets location of text<br>Two point digitizing defines slope of words<br>Three to 5-point digitizing of an entry defines a line, characters are evenly spaced along the line defined by digitized points<br>Six or more point digitizing of an entry defines a line, characters are spaced evenly along a <u>splined</u> line defined by the digitized points. |
| 800-899 | Polygons, more closed figures that can be patterned, just like the 400-499 codes, but adds another 100 codes for polygons.                                                                                                                                                                                                                                                                                                                                                                           |

### CONFIGURATION FILES

Three configuration files are required to describe the configuration of the hardware and to set communication parameters: they are named CONFIG9.DIG, CONFIG9.PLT, and CONFIG9.SCR, for the digitizer, plotter, and screen (monitor) respectively. A fourth file, CONFIG9.SYM, contains definitions of symbols.

#### CONFIG9.DIG

Digitizer configuration. The first record (line) of this file sets communication parameters between computer and digitizer. The second line configures parameters for systems using multi-key keypads or a single button cursor using a menu template on the digitizer table to set functions. For multi-key cursors, additional lines serve as a translation table to match keys with ASCII characters expected by programs. Final lines configure the frequency and duration of sounds during digitizing.

#### CONFIG9.PLT

Plotter configuration. The first record (first line) of this file sets communication parameters between the computer and the plotter, the second record specifies parameters for draft mode plots (label character and circle size). The remaining records (lines) contain complete definitions of line patterns (line types 0-16). Changes can be made by an informed user.

#### CONFIG9.SCR

Configures screen graphics mode. The single line of this file establishes the type of graphics used by the system. Colors seen on the screen when using EGA or VGA color graphics systems are determined by the pen number chosen in the operative control file.

#### CONFIG9.SYM

This ASCII file contains the definitions of symbols; additions can be made by the user.

#### DATA BASE

GSMAP and GSLITH data bases manage information using two files. These files have the same name, but different extensions. Coordinate data is stored in a file with extension LSF; an index file with extension NDX provides quick access to the data. Operation of this system is invisible to the user. The two files together constitute a data base. These two files are direct access binary files; these speed operation of these programs and reduce the size of the files.

#### DATA BASE CORNERS

Each GSMAP and GSLITH data base has four corners. Geodetic data bases have NW, SW, SE, and NE corners. These are the default corners for digitizing and plotting. These labels apply to the hard copy map, not to its orientation on the digitizer. Similarly, Cartesian coordinates have UL, LR, LL and UR corners, each applying to the normal viewing position for the illustration (they don't change if you stand on your head). Upper and lower don't refer to local gravity directions; we must admit no experience with temporary gravity reversals. With typical wisdom, the Wizard has not programmed the audio part of the index procedure to play "Brighten..."

#### DEFAULTS

Default responses to prompts (hit the ENTER key) are shown using UPPER CASE letters, other valid responses in lower case letters. There are no default responses to some prompts, you're paid to do some of the work, and no, we have'nt programmed answers for the S&L defaults; obviously our computers are much too small.

#### DELAUNAY TRIANGULATION

A set of points in X,Y,Z space are joined by non-intersecting straight line segments to form a network of planar triangular facets to build a complete surface by interpolation between data points. The grid formed from these facets has regular (user defined) X and Y coordinates and Z values determined by linear interpolation between data points. No extrapolation, no magic, no unexpected boundary effects due to unseen mathematical manipulations.

#### DISCLAIMER

The statement on the first page of an Open-File Report or on the first screen seen when running a program. It puts all responsibility back on you. Just like a wizard to do that.

#### DOCUMENTATION

The systematic description of a program and how it works. The word is always preceded by a pejorative adjective or followed by a negative clause like "it won't win a Pulitzer Prize". Never read documentation, or at least never admit to having read the documentation. Use it for reference only if a Guru or Wizard is unavailable. Or angry. This documentation combines the descriptions of many programs, following Franklin's tenet of "saying grace over the whole barrel of beef at once, in order to save time".

#### DRAFT MODE

In GSMAP draft mode plots the number of the entry will be drawn just to the left of the first point of the entry and for code groups 1-99, 400-499, 600-699 a small circle is drawn around this point. In publication mode neither the number nor the circle will be drawn. The intent of the draft mode is to facilitate editing of the data base. Draft mode plot control files can facilitate editing using GSMEDIT; circles will be drawn on the screen at the starting and ending points of each line.

#### EDIT DISTANCE

The edit distance is a distance in inches set at the beginning of a digitizing session. An edit distance of 0.1 inch is a good value to try. It's also the default distance (hit the Enter key). In the Edit Mode the cursor of the digitizer is used to identify entries. To identify an entry the cursor must be closer to it than the edit distance.

#### EDIT MODE

GSMAP supports interactive editing in the "Edit Mode" reached using Option 3. This mode is reached from the \*Input Mode using the C key. In the Edit Mode, points can be moved, deleted, CODE, P1, and P 2 changed; lines segmented; and entries deleted. GSMEDIT is usually in the edit mode; it's input mode is reached using the H hot key.

#### ENTER

If you are asked to enter something from the Keyboard, type the letters and numbers and immediately afterwards strike the Enter key. If you are entering the name of a data base type the name without extension(s); If the name of a file, type the full name with extension. If you are asked to enter something from the keypad of the digitizer press the appropriate buttons on the keypad while it is within the active area of the digitizer board; if the digitizer is in MENU mode, move the digitizer to the appropriate circle on the menu template, then hit a key. These definitions only apply if the computer and digitizer have first been turned on. If you are using the plot register PR option for plotting, the ENTER key on the plotter must be used. On some plotters these keys are labelled, but some aren't, so, look in the index of plotter's documentation under ENTER or under DIGITIZE.

#### ENTRY NUMBER

In GSMAP the entry number is a sequential number, starting with 1 for each illustration. It is assigned by the program for each entry, whether a line, a symbol, or a block of text. Adding, deleting, undeleting, and changing parameters for entries are based on the number of the entry. The entry number is supplied on the screen during digitizing, is drawn on "draft mode" plots to the left of the first point digitized for each entry), and can be obtained from listings on the screen or on the printer. It is displayed on-screen during plotting as each entry is plotted.

#### ENVIRONMENTAL VARIABLES

Rain, snow,...., NO, this is a serious exposition about computers, so another meaning is meant. The DOS operating system looks for files only in certain places, for example those specified in the PATH statement. If files such as the configuration files and the font files are needed by an application program such as GSMAP, DOS isn't smart enough to look anywhere except in the active directory. You can teach it to look for these files in another place if you specify the place in the AUTOEXEC.BAT file and if you and the WIZARD agree on the name of that place. For the GS programs, the wizard decreed that these files shall be placed in a directory you can specify using the statement SET GSFILES=XXX. But don't use XXX, it's too high spirited. DO create a directory for the purpose, stash configuration and font files in it, and forget about environmental variables until you need your umbrella. By the way, if you set the

environmental variable, but leave the configuration files in the active directory without copying them into their proper directory, DOS will tell you that they are missing. It won't look in both places.

#### EXTENDED CHARACTER SET

ASCII characters 128-254 form the extended character set. Some of these have been defined in fonts #0, #1 and #2 to provide characters useful for workers in the sciences. In Font #0 the \ has been redefined so that it will plot the Cambrian C (one of the special characters), but there aren't enough keyboard characters for all purposes. Figure 5 shows the characters that have been defined in the extended set and the ASCII numbers for each. These characters are used only in text files. If an undefined character is used, a blank will be plotted. Look for it.

#### FILE NAME

When a prompt calls for entry of the name of a file, type its full name with extension (type the full name of the file with its extension and path statement, if other than the active drive. Then hit the ENTER key).

#### FONT FILES

Numbered files with an extension .FNT are supplied. These ASCII files contain the definitions of characters used by the plotter. 0.FNT is the default font file, used if the one you specify isn't in the default area of the computer.

#### G.O.D.

Guardian Of Data. This means you. Keep Commandment XI. The only thing worse than bothering to back up data is regenerating it after you lose it.

#### GLORIOUS ENTRY

The programs in this release can be started and data files or plot controls selected from the DOS prompt. For GSPOST and GSPCS type the name of the program followed by a blank space then the name of the plot control file, then hit the ENTER key. For the other programs type the name of the program followed by the name of the data base, then hit the ENTER key.

#### GRIDDING

The art of taking XYZ data from random X and Y locations and constructing XYZ files in which X and Y are regularly positioned in Cartesian space. Many gridding algorithms are used, all make important assumptions about the data. Gridding is done so that contours can be generated by a computer.

#### GSPOST FILES

GSPOST format data files are used by one group of programs in this release. These files are row-column files. The first column provides the identifier of the site, the second (group, if in degree, minute second format) the X coordinate or Latitude, the third (group, if in degree, minute second format) the Y coordinate or Longitude, the next three are control columns used by GSPOST for alternate posting positions and rotation parameters, and the next are data columns (up to 50), each providing a number related to this site. The first line of the file must contain information about the file. In sequence, the number of data rows, the number of columns, the number of lines of text between line 1 and the first data record, and characters that specify the format of the file. These characters must be selected from the following: GDD=geodetic, degrees latitude, degrees longitude; GDMS=geodetic degrees minutes seconds compass direction latitude, degrees minutes seconds compass direction longitude, C=Cartesian, N=No coordinates (no alternate posting positions, no rotation angle). Not surprisingly, the No coordinate format can only be used with the statistics/graphic programs of this release.

#### GURU

A person believed by someone else to know more about a program than he does.

#### HE, HIM

Sorry about the sexist terms, but please take no offense. The awkwardnesses of inclusive language are avoided in this epistle by assuming that the reader will supply the missing genders, if he, she, it desires.

#### HOT KEYS

Prompts for GSMEDIT, GSMPBS, and GSPOST call for the use of HOT KEYS, e.g. keys on the keyboard that perform their functions without a subsequent stroke of the ENTER key. This technique has been adopted to expedite editing sessions, and is especially necessary when the mouse is being used as the pointing device. It calls for caution. Hit a hot key, and you are in for the whole pound.

#### HPGL

Shorthand for Hewlett Packard Graphics Language. HPGL is used by GSMAP to instruct the plotter.

#### HORSESHOE NAIL

Carriage return. The lack thereof can create problems at the end of a plot file. One too many (a blank line at the head of a plot file) can create different problems. Either is hard to spot on the screen.

#### INCREMENTAL MODE DIGITIZING

The way some digitizers are set up; if you hold a key down and move the keypad more than a certain amount, perhaps 0.01 inch, the digitizer will send a point to the computer. Watch for this. If this is the case, don't digitize points on the move, or better, set the switches for point mode. GSMAP supports point mode digitizing. Other modes may work, but you are on your own if you use them.

#### INPUT MODE

Option 3 of GSMAP (DIGITIZE NEW ENTRIES) opens in Input Mode for digitizing new entries. The \*Edit Mode is reached from the Input Mode using the C key. The input mode of GSMEDIT is reached by hitting the H hot key.

#### JUMPSTART

The educational equivalent of a cup of strong coffee, two sugars, no cream.

#### LANDFILL

"Land being rehabilitated for future productive use." This definition from the SDTS standards document p. 27.

#### LEVEL

Webster variously ..., conforming to the liquid parts of the earth's surface, honest ... has to be something else. Used with GSMAP and related programs used to specify the stage of development relative to the stages of development of GSMAP.

#### LINE TYPE

A number that is used to specify the pattern used to draw a line. Line types 0-17 draw lines, type 99 is a phantom trace known only by its decorations, 98 a pair of parallel lines drawn at a specified spacing on each side of a single digitized line. The width of a line is determined by selecting the pen used to draw it. This has nothing to do with the line type. Remember All lines are digitized as if solid.

#### LIVEWARE

Self-styled experts with half-vast experience who purport to teach, despite lacking expertise.



## MOUSE

Noun, a dark colored swelling caused by a blow, verb, to move stealthily, see Webster, pronoun, a gadget used as a pointing device by advocates of GUI programs; an excellent device for three-handed people, a G.I. elephant for use in elephant country. Used in Version 9 GSMEDIT, GSMPPBS, and GSPOST for moving about the graphics screen if you have appropriate entries in the computers CONFIG.SYS file and if a Microsoft mouse driver has been installed; don't look here for instructions.

## NAD

Stands for North American Datum. Almost all USGS maps use the 1927 datum. Quadrangle corners are provided on many new maps for NAD '83. Stick with NAD '27 until further notice. We'll call you. Don't call us. NAD '83's a good reason to record the edition of the base map used for digitizing. Yes, there is a computer program for converting forth and back. Be especially careful with GPS devices; some are biNADal; most generate WGS 84 = NAD 83 coordinates.

## NODE

Webster's first definition .. "an entangling complication" .. is about right. Nodes were used in Version 5.0 of GSDRAW and GSMAP to identify points where lines should meet. then not supported in versions 6-8. Nodes and node files are once again supported by Version 9.0 of GSMAP, and editing made practical by functions and display of nodes as added to GSMEDIT, with support for interactive editing on the screen.

## OBSOLESCENCE

The inevitable fate of static programs. Successive versions of GSMAP have been published at "appropriate" intervals. Data files of versions 3-8 are upwardly compatible. The price of avoiding obsolescence and moving from Version 6.0 to Version 9.0 is the revision of plot control files for polygons, decorated lines, and 100-199 codes. Sorry about that. You have our permission to keep using Version 1.0. Our royalty is the same. Purists can run GSMAP and GSDRAW Version 1.0 using BASICA. This takes geologic time. That's one of many reasons that you may prefer Version 9.0.

## P1, P2

P1 and P2 are abbreviations for Parameter 1 and Parameter 2. Code, P1, and P2 are numbers for each entry that tell the program what the entry is. In the language of GIS these are the attributes of the entry. For example, Code 201 is the symbol representing the dip and strike of inclined beds, for this code P1 is the bearing of the strike line, and P2 the dip of the bedding.

## PIEP

PERGAMENTUM INIT, EXIT PERGAMENTUM If it's garbage in, it's garbage out. Remember that even if the data's great, but the method of processing pyramids too many assumptions, it's time to take the garbage out, even if the software operates correctly. Be especially wary of assumptions when gridding, and when using statistical methods that require a normal distribution.

## PLOT CONTROL FILE

An ASCII file that specifies your use of codes to the computer; in GSMAP Version 9.0 it's used for digitizing, editing, and plotting whether to the screen, to an HPGL file, or on the plotter. One is required to work with any data base. GSPOST and GSPCS also require plot control files. Sample plot control files are provided with this release, so copy, edit, and enjoy the benefits on the screen. You may have noticed that a "Line" format and a "Cumulative" format GSPCS file differ by a single character, so if you plan ahead, two files can be prepared for the price of one plus a keystroke. Let there be no doubt. Plot control files for GSMAP won't operate correctly with GSPOST and GSPCS and versa with vice, but go ahead and try if it suits your purposes.

## POINT MODE DIGITIZING

Used for digitizing lines and points. This mode leaves you in control. Hit a key. Get a point. This way you can ensure that the cursor of the digitizer is exactly where you want it when you digitize each point.

## PROJECTION FILES

Also called projection parameter files. They are typed before needed, or copied and modified from one of the release disks, if you are lazy or smart. With geodetic coordinates they provide information to the computer needed to specify the map projection and to specify the size and shape of the Earth. Clarke's polar and equatorial radii of 1866 are used for almost all USGS maps. Take that, all you satellite types who insist on remeasuring our planet.

## PSYCHOSCLEROSIS

An old disease with a new name characterized by a hardening of the attitudes. A characteristic symptom is the ability to talk at length about the critical need for change, but the inability to get beyond "the way it's always been done" as the final answer. The hurrier a sufferer talks, the behinder \*he gets.

## REGISTERER

A person who registers a plot to precise corners using the plot register option of GSMAP or GSPOST. Used normally to identify a long-armed friend who can look through the digitizing sight and still reach the controls that move it to the precise positions for indexing points on the left side of the plot sheet on an E size plotter. We have it on absolutely impeccable authority that HP hired the staff who tested digitizing on their largest plotters from a roster of EX-NBA centers.

## SCAN

As used here, "to glance from point to point often hastily, casually, or in search of a particular item": the way documentation is generally consulted.

## SDTS

Despite assertions to the contrary, not a communicable disease. These initials stand for Spatial Data Transfer Standard. The purpose is to facilitate interchange of spatially referenced (GIS) data. GSMAP data bases don't meet the SDTS standard for many reasons. We are optimistic that some fine day they can be processed to meet this standard, see \*AGE, \*LANDFILL. Why don't you write the code. Can you assemble a camel from horse parts?

## SECTION DISTANCE

The SEC.DST or "selection distance" is used by GSPCS. The default distance is 2, units if Cartesian, km if geodetic. Points within the selection distance of the line of section will be used to construct the graphic section. Don't assume that 2 is the optimum number; do check sections by plotting on the screen. Change the section distance using the F hot key.

## SPECIAL CHARACTERS

Nope. Not a field geologist in this day of computers. A few characters of special use to geologists have been redefined in Font #0; these include the Cambrian C, the Triassic Tr, Pennsylvanian P, degree and second characters. A multitude of non-keyboard special characters has been included in the extended character set of Fonts #0, #1 and #2. The special characters of font #99 can be used by those who lack an ALT key

## SNAP DISTANCE

A distance used when digitizing in GSMAP and editing in GSMEDIT, and by one of the options of GSMUTIL to perfectly join intersections of lines. Points within this distance of the end of a line are joined to that ending. The term has nothing to do with how close you can get to a Wizard with a corrupted version of his source code before ... A snap distance is not used by the GSMAP program itself.

#### SPLINE

Refers to splined lines, CODES 600-699. A sort of curve fitting to a cubic equation done by the computer to draw smoother curves. Splining connects points at equal intervals down the line, adding to the ones you digitize to make people think you did more work than you really did. You can spline a line to a data base if you wish, using GSMUTIL. If you aren't careful the computer will throw you a curve that's different than the one you expect, just to get its hard-earned pound of flesh.

#### STREAM MODE DIGITIZING

Points are sent at timed intervals from the digitizer to the computer while a key is depressed. As you follow the line the computer sorts the points, determines which ones are needed based on a very clever algorithm, and stores only those points. We do not support or recommend stream mode digitizing to anyone who cares about the quality of data. GIGO.

#### STRIKE, HIT, TAP, PRESS, DEPRESS, PUNCH, etc.

That that you do to a key on the computer keyboard to make the thing work. Permission is hereby given for you to edit your own copy of the documentation to ensure that only one of these terms is used. Leave mine alone.

#### SYMBOLS

"Symbols go beyond the rational conscious mind into the realm of the unconscious sic., where soul memories reside. Meditation on such archetypal images gives one a feeling of oneness with the universe and unlocks the door to higher understanding." Bet you never realized the power of a strike and dip symbol (CODE 201) on a geologic map.

#### SYSTEM 9

System 9 encompasses a group of GS programs released as Open File reports; all use the same set of CONFIG9.\* configuration files, include the use of the environmental variable GSFILLES and support a consistent set of hardware, including computer, digitizer, and plotter. We have tried to make the practices of the various programs consistent so that learning one makes learning a second easier.

#### TEXT FILE

ASCII files in a specified format are used for input of text, codes 500-599, 700-799. These can be created using option 6 of GSMUTIL, or by using a text edit program. Be very careful to get the format exactly right or GSMAP will bite the hand that's feeding it.

#### TOLERANCE DISTANCE

A tolerance distance is specified when using the "Filter" options of GSMUTIL. The line plotted using a filtered data base will be within the tolerance distance of all points digitized into the input data base at the scale specified when filtering.

#### .TMP

As in a file named 462062.TMP that mysteriously appears and occupies space on your hard disk. The programs in this release that write "scratch" files to disk name these files with a six digit number and the extension TMP. These scratch files are deleted by the program if you leave the program in the normal way after operations are complete. If you abort operations (^C or if a defect in the plot control aborts operations prematurely and sends you to the DOS prompt, these files may not be deleted. Check your directories for files with the "TMP" extension - these may be souvenirs of misadventures past and do tend to hog the disk.

#### TRAINING

See "workshop. Teaching isn't the issue. Learning is. Watch out for sessions put on by "liveware. "Humans hardly ever learn from the experience of others. They learn - when they do, which isn't often - on their own, the hard way", (Heinlein, 1973).

#### TRIM FILE

ASCII files in defined format used with GSPDC to restrict the area contoured. The four corners that are specified (interactively or in the plot control file) with GSPCS perform the similar function of defining the area for data plotting. See also trim functions in utility programs.

#### UNDOCUMENTED FEATURES

The stuff we know that you don't, whether it's in the written documentation or not.

#### VAINGLORIOUS EXIT

At any time that a program is expecting a response from the keyboard bit the Control key and the C key together (^C and operations will return to the DOS prompt. F9Q halts plots. The E key from the digitizer keypad brings operation back to a point where entry of code 999 (GSMAP) brings operations back to the computer keyboard so that exit using ^C is possible.

#### WARRANTY

Why do you ask. If we can't fix it, it ain't broke. User error covers all our sins that the disclaimer doesn't.

#### WIZARD

The person who knows the most about a particular program, including detailed knowledge of the source code. Limit, One wizard per program.

#### WORKSHOP

A jump start for those who can't or won't read documentation. But remember, "No one really listens to anyone else, and if you try it for a while you'll see why."

XI The eleventh commandment. **THOU Shalt make backups**

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