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GSDRAW AND GSMAP: PROTOTYPE PROGRAMS FOR THE IBM PC OR COMPATIBLE MICROCOMPUTERS TO ASSIST COMPILATION AND PUBLICATION OF GEOLOGIC MAPS AND ILLUSTRATIONS

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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.

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INTRODUCTION

GSDRAW and GSMAP are prototype programs for IBM PC (and compatible) microcomputers to assist geologists and illustrators in compilation and publication drafting of geologic maps and diagrams. They represent an effort to do for geologic drafting what digital word processing has done to facilitate composition and publication 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 change, and lead from initial compilation to publication without redigitizing or redrafting. Design goals focused on an "office scale" system, with an affordable price.

This release includes GSDRAW and GSMAP in versions 1.0; we regard both as prototypes. GSDRAW is based on storage of X-Y coordinate data unique to each illustration; GSMAP is based on storage of geodetic coordinates (UTM); the two programs are otherwise the same. GSDRAW is used for illustrations, cross sections, and maps where there is either no latitude/longitude grid, or the use of a latitude/longitude system is not necessary; GSMAP enables digitizing a geologic map in pieces, and combination of the pieces in their proper places in Universal Transverse Mercator projection. A basic set of line and geologic symbol types has been included; additions can be made by computer-oriented users. These programs do not attempt the sophistication of the CAD systems available for engineers, and are plotter oriented rather than screen oriented. Screen graphics are used to assist digitizing and editing, rather than as primary tools in design.

These versions of GSDRAW and GSMAP are prototypes released because they are useful, despite lack of polish and device independence. The principal roles of the three authors are as follows: Gary Selner, program design and programming; Richard Taylor, geologic input and documentation; Bruce Johnson, hardware system design. Constructive criticism, suggestions and comments are welcomed.

SYSTEM REQUIREMENTS

Hardware

GSDRAW and GSMAP have been implemented on IBM PC/XT microcomputers. The minimum configuration for utilizing the programs is as follows:

IBM PC or equivalent w/128K RAM, one floppy disk drive
Two serial ports (one for digitizer, one for plotter)
One parallel port (for printer)
A graphics card equivalent to the IBM color/graphics adaptor
A monitor equivalent to the IBM color/graphics monitor
Printer with screen dump capability
GTCO Digi-Pad 5, 11"x11" digitizer w/16-button cursor
Hewlett-Packard HP-7550A 11"x17" plotter

The system that is more suitable for moderate to large applications is as follows:

IBM PC w/256K RAM, 2 floppy disk drives
STB Systems Inc. "Chauffeur" display card
Multi-function card w/384K RAM, clock, 2 serial ports; AST 6-Pack or equivalent
Iomega Bernoulli Box cartridge disk system, dual drive, 10 Megabytes per cartridge
Okidata 193 Printer, or equivalent
GTCO Digi-Pad 5, 11"x17" or larger digitizer w/16 button cursor
Hewlett-Packard HP-7550A 11"x17" plotter, or larger HP-7500 series plotter

The authors did not have access to all equipment that is advertised as IBM PC compatible; however, the programs were briefly tested on a Compaq portable, a Columbia and an IBM PC/AT with no apparent problems.

Software

GSMAP and GSDRAW were written and tested using the Advanced BASIC Interpreter of IBM DOS 2.1 (BASICA). The programs were then compiled using the Microsoft QuickBASIC Compiler to improve execution speed. The programs make use of certain graphics features that are not supported under the IBM BASIC Compiler Version 1.0. The program has been tested using 128K of RAM memory and using DOS 3.0. The release diskette available in U.S. Geological Survey Public Information Offices contains the source code in ASCII format, the executable code generated by the QuickBASIC compiler for both GSDRAW and GSMAP, and a copy of the symbol file (GSCAD.SYM).

The minimum software requirements for utilizing the programs is PC/DOS, the release diskette and a word processing program capable of producing ASCII files. The authors utilize Wordstar in non-document mode as the word processing program. For users who wish to modify the BASIC code a copy of the Microsoft QuickBASIC Compiler is recommended. The compiled version vastly improves execution speed.

THE CONCEPTS BEHIND GSDRAW AND GSMAP

GSDRAW and GSMAP use a high precision digitizer and plotter for entry of digital data and plotting. Program capabilities include editing of data after digitizing, deletion of unwanted items, and addition of items at any time to the digital files. Part or all of the data can be plotted. Words and alphanumeric characters are entered using a word processing program, and their locations are entered by digitizing. Entries are numbered by the program, and edited or deleted according to this number. Although results can be partly viewed on screen, the primary output is to the plotter. Plots are made in two forms; a "draft" mode provides line numbers for each entry; the normal mode provides copy for review and publication.

A few definitions are essential to understanding subsequent sections:

line number - a sequential number, starting with 1 for each illustration, and assigned by the program for each entry, whether it is a line, a symbol, text, etc. Additions, deletions, and modifications to the digital file are based on the line number of the entry being changed. Information on the line number of the entry is supplied on the screen during digitizing, is included on "draft mode" plots, where the line number is plotted to the left of the first digitized point, and can be obtained in printed listings.

line code - a number entered by the user from the digitizer keypad, one to three digits, with functions defined by the program for six different groups and by the user within those groups. Details of the functions of different line code groups in digitizing and plotting are provided in the reference section of this report.

line type - a number, 0-12, defined in the plotter for different kinds of lines - solid, dotted, dashed, etc. The width of a line is determined by the pen used to draw it; the "pattern" (dashes, dots, etc.) is specified by line type.

GETTING STARTED

Hardware and software available and ready ?? See Appendix 1 for information on installation to supplement information supplied with the equipment. Make sure that all equipment is ready and turned on.

GSDRAW or GSMAP ?

The capabilities of these two programs are similar, but not identical.

- Use GSMAP for latitude/longitude dependent data, especially where digitizing will be conducted in several pieces and merging of databases will be needed. Lettering will NOT change scale in GSMAP as a function of plot scale. For accurate digitizing, maps must be UTM (Universal Transverse Mercator) projection.

- Use GSDRAW for diagrams and maps lacking latitude/longitude data, or where plotting of lettering should change size with change of scale. Databases cannot be merged, although plots of several sets of data can be made on the same piece of paper.

OPERATING THE PROGRAMS - GSDRAW AND GSMAP

GSDRAW and GSMAP are invoked by entering the name of the program desired; a title screen is succeeded by a menu providing a choice of options.

MENU

GSDRAW and GSMAP operate from menus that are almost identical. In the following sections, most comments apply to both programs. Differences are highlighted.

MENU GSDRAW

G S D R A W

CURRENT DATA BASE:
MAP TITLE:

1 - START A NEW DATA BASE
2 - OPEN AN EXISTING DATA BASE
3 - DIGITIZE NEW LINE SEGMENTS
4 - DELETE LINE SEGMENT
5 - RECOVER LINE SEGMENT
6 - CHANGE PARAMETERS FOR LINE SEGMENT
7 - LIST CONTENTS OF DATA BASE
8 - PLOT ON THE SCREEN
9 - PLOT ON THE HARD COPY PLOTTER
10 - EXIT

ENTER CHOICE BY NUMBER:

MENU GSMAP

G S M A P

CURRENT DATA BASE:
MAP TITLE:

1 - START A NEW DATA BASE
2 - OPEN AN EXISTING DATA BASE
3 - DIGITIZE NEW LINE SEGMENTS
4 - DELETE LINE SEGMENT
5 - RECOVER LINE SEGMENT
6 - CHANGE PARAMETERS FOR LINE SEGMENT
7 - LIST CONTENTS OF DATA BASE
8 - PLOT ON THE SCREEN
9 - PLOT ON THE HARD COPY PLOTTER
10 - MERGE ANOTHER DATA BASE
11 - EXIT

ENTER CHOICE BY NUMBER:

START A NEW DATA BASE

Entering 1 from the menu will start a new data base
GSDRAW

The first entry requested -
ENTER MAP DATA BASE NAME:

This request is for the name of the file that will contain the data for the map (or illustration); for this document, this will be called MAPNAME. No more than eight letters (or numbers) can be used. The next entry requested -
ENTER TITLE OF MAP:

This is a request for the name that will be associated with the map; for this document, this will be called MAPTITLE. No more than eight letters (or numbers) can be used. After entry of MAPTITLE, the screen will clear and the next four requests will ask for entry of the four corners of the map on the digitizer -
ENTER UPPER LEFT CORNER ON DIGITIZER -
ENTER LOWER LEFT CORNER ON DIGITIZER -
ENTER LOWER RIGHT CORNER ON DIGITIZER -
ENTER UPPER RIGHT CORNER ON DIGITIZER -

Use the "0" key on the digitizer keypad to enter the points requested. Note that UPPER, LOWER, LEFT, AND RIGHT apply to the map, not to the digitizer. The orientation of the map on the digitizer is not important. The UPPER LEFT CORNER and the LOWER LEFT CORNER define the vertical direction for plotting routines.

Entering a 1 from the GSMAP menu will begin the process of starting a new data base.

The first entry requested -
ENTER MAP DATA BASE NAME:
This request is for the name of the file that will contain the data for the map; for this document, this will be called MAPNAME. No more than eight letters (or numbers) can be used.
The next entry requested -
ENTER TITLE OF MAP:
This is a request for the name that will be associated with the map; for this document, this will be called MAPTITLE. Up to 16 letters (or numbers) may be used.
After entry of MAPTITLE, the screen will clear and the next four requests will ask for entry of the latitude/longitude coordinates of the four corners of the map from the computer keyboard -
ENTER LAT/LON OF NORTHWEST CORNER
DD,MM,SS,DDD,MM,SS
ENTER LAT/LON OF SOUTHWEST CORNER
DD,MM,SS,DDD,MM,SS
ENTER LAT/LON OF SOUTHEAST CORNER
DD,MM,SS,DDD,MM,SS
ENTER LAT/LON OF NORTHEAST CORNER
DD,MM,SS,DDD,MM,SS

There will be no request for entry of these points on the digitizer at this time. Completion of input of the four coordinates in required form (commas separating the numbers for degrees, minutes and seconds), will cause return to the menu.

Notes:

- In both GSDRAW and GSMAP, if you attempt to use a MAP DATABASE NAME that is already in use, the computer will inform you of this -
A FILE WITH THE NAME OF MAPNAME ALREADY EXISTS
DO YOU WANT TO CONTINUE(Y/N)?
  - If you answer Y, the program will continue and the old file will be overwritten.
  - If you answer N, the program will once again request entry of a new MAP DATA BASE NAME
- The corner points chosen for either program are very important. Proper indexing to the digitizer requires that the points be readily identifiable and precisely located. One kind of mark that is easily identified and very precise is a shallow cross cut with a knife blade in a mylar original; a plus made with a 9H pencil serves well for a paper original.

OPEN AN EXISTING DATA BASE

For both GSDRAW and GSMAP, entering 2 from the menu will elicit a request -
ENTER MAP DATA BASE NAME:
Entry of the database name (MAPNAME) will open the file, and cause return to the menu.

If no data base with the name entered exists in the files accessible to the computer, a request for a proper DATA BASE NAME will be made -
AN ERROR HAS OCCURRED OPENING DATABASE MAPNAME
CHECK DATABASE NAME. HIT ANY KEY TO RETRY
- Hitting any key will cause the request for a map data base name to return to the screen; a proper entry will cause return to the menu.

Note:

- Each session with GSDRAW or GSMAP must start either by starting a new data base (1) or by opening an existing data base (2).

DIGITIZE NEW LINE SEGMENTS

Entering 3 from the menu will open the program for digitizing new lines.

GSDRAW

The menu screen will clear and the next four requests will ask for entry of the four corners of the map from the digitizer keypad (use the "0" key).

ENTER UPPER LEFT CORNER ON DIGITIZER:
ENTER LOWER LEFT CORNER ON DIGITIZER:
ENTER LOWER RIGHT CORNER ON DIGITIZER:
ENTER UPPER RIGHT CORNER ON DIGITIZER:

Move the cursor to each corner in turn, and at each location use the "0" key on the digitizer keypad to index the map to the digitizer tablet. Following the entry of the fourth corner, the screen will clear and an entry will be requested -

DISPLAY PREVIOUS DATA? (Y/N)

- A "N" will enable digitizing to begin immediately; the outline of the map and new lines will be displayed on the screen.
- A "Y" will cause all previous lines to be displayed as well as new lines as they are digitized. A high pitched tone will indicate that the system is ready to receive new data points.

GSMAP

The menu screen will clear and the next four requests will ask for entry of the four corners of the map from the digitizer keypad (use the "0" key). A "beep" will sound as each is entered.

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 digitizer keypad to index the map to the digitizer tablet.

- If there is a problem with corner points digitized or their match with the defined latitude/longitude coordinates, a message will be shown on screen -

SCALE DIFFERS BY MORE THAN 2 % IN X AND Y
CONTINUE? (Y/N)

- A "N" will return you to the menu screen. A "Y" will allow you to proceed. This message should prompt careful checking of all parameters entered into GSMAP and the hard copy being digitized.

If no scale problem is identified after digitizing the fourth corner point or a "Y" answer is given to the CONTINUE? question, the screen will clear and an entry will be requested -

DISPLAY PREVIOUS DATA? (Y/N)

- A "N" will enable digitizing to begin immediately; the outline of the map and new lines will be displayed on the screen.
- A "Y" will cause all previous lines to be displayed as well as new lines as they are digitized. A high pitched tone will indicate that the system is ready to receive new data points.

Screen display during digitizing - GSDRAW and GSMAP

The entire screen will be used for display during digitizing (despite the distortion that differing X and Y display scales may cause), to make full use of the limited resolution of the screen. The screen will show an outline corresponding to the corner points digitized, and a line of characters at the bottom:

LINE ___ CODE ___ PARA 1 ___ PARA 2 ___ NO. OF PTS ____

After a line is digitized this line of text will show: Line Number, Line code, Parameter 1, Parameter 2, and Number of points digitized to make up this line. The use of line code groups and the meanings assigned to Parameter 1 and Parameter 2 is described in the Reference Section of this report.

Resetting of area of on-screen graphical display

The area on the diagram shown on the screen can be reset from the digitizer. Entry of a "B" from the keypad, 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. Selection of an area with proportions similar to those of the screen will minimize on-screen distortion. Use of a screen-size template will give 1:1 correspondance between the hard copy and the screen.

Digitizing data

Three entries are made from the keypad digitizer before entering data points:

- Line code, 1-3 numbers (if less than 3, the "A" key is used to complete this entry)
- Parameter 1, 0-6 numbers (if less than 6, the "A" key is used to complete this entry)
- Parameter 2, 0-6 numbers (if less than 6, the "A" key is used to complete this entry.

Information on the functions of the six line codes and the meanings assigned to Parameters 1 and 2 is contained in the REFERENCE SECTION.

The "PUNT" key -- "F"

At any time during digitizing an entry, hitting the "F" (the "PUNT" key) will delete the entry; this avoids the necessity of deleting an entry known to be defective during the digitizing process. Such entries will not be shown on the screen at any time.

Ending a digitizing session - 999

999 entered from the keypad will end a digitizing session and return program execution to the menu screen.

Notes:

- WARNING - Errors will result if the hard copy moves on the digitizer, so fix it securely (so that it won't move). If it should, go back to the menu, and re-enter the database. Then properly index the copy to the digitizer.
- So long as a session within the same database is continuous, reindexing of hard copy with the digitizer tablet will not be required.

DELETE LINE SEGMENT

A 4 entered from the menu will begin a session in which lines can be deleted.

In both GSDRAW and GSMAP a response must be made to the query -
GRAPHICAL DISPLAY ? (Y/N)

- A "N" prompts the query -
ENTER LINE # TO BE DELETED (0) TO QUIT:
- Entry of a line number deletes the line, and redisplay of the deletion question. A "0" returns program execution to the menu. The "N" option enables a deletion to be made without waiting for completion of the screen graphical display.

- A "Y" will cause all previously digitized lines to be displayed on the screen. The query -
ENTER LINE # TO BE DELETED (0) TO QUIT:
prompts entry of the line number to be deleted. The line will be deleted from the screen, and a second query will appear the on screen -
DELETE? (Y/N)
This allows second thoughts and requires confirmation that the line is indeed to be deleted. A "N" causes the line to be replotted on the screen, a "Y" will cause a a repeat of the ENTER LINE # TO BE DELETED (0) TO QUIT: instruction.

- A "0" supplied in answer to the deletion question causes return to the menu.

RECOVER LINE SEGMENT

Entry of a 5 from the menu enables a deleted line to be recovered in both GSMAP and GSDRAW.

The request from the computer -
ENTER LINE # TO RECOVER (0) TO QUIT:
prompts entry of the number of the line to be restored to the active data base. Entry of a "0" causes return to the menu.

CHANGE PARAMETERS OF A LINE SEGMENT

Entry of a 6 from the menu enables change of line code, Parameter 1, and Parameter 2. Such changes might be needed to modify the size of lettering, plotting characteristics, character of lines, or to correct errors of entry from the keypad during digitizing.

An on-screen prompt -
ENTER LINE # TO BE CHANGED (0) TO QUIT:
calls for entry of the line number to be changed. On-screen information will be supplied showing the "old" line code and parameters of the line, and a request for the desired parameters -
OLD PARAMETERS= 1 0 0
ENTER NEW VALUES(LCODE,VAL 1,VAL 2):

Entry of the desired line code, the value of parameter 1 and the value of parameter 2 (separated by commas) causes the requested changes in the database.

Entry of a "0" causes return to the menu.

LIST CONTENTS OF DATA BASE

Entry of a 7 for both GSDRAW and GSMAP will provide a listing of information included in the data base, either on the screen or the printer.

A screen prompt begins the session --
PRINT ON SCREEN OR PRINTER (S/P):
-Entry of "S" or "P" as desired is followed by --
FUNCTION KEY 9 TO PAUSE, Q TO QUIT, RETURN TO CONTINUE
- Information supplied will be

MAP NAME
Coordinates of upper left point Coordinates of upper right point
Coordinates of lower left point Coordinates of lower right point

and -
ENTER LINE CODE(-1 FOR ALL, 0 TO QUIT)
- Entry of the desired line code will provide the following information (either on screen, or on the printer)

For GSDRAW
Line number, Parameter 1, Parameter 2, X and Y coordinates of the first and last points of the line. The X and Y coordinates are measured in inches, using the lower left corner of the map as the origin.

For GSMAP
Line number, Parameter 1, Parameter 2, UTM coordinates of the first and last points of the line.

Entry of "0" causes return to the menu.

PLOT ON THE SCREEN

Entry of an 8 from the Menu for both GSDRAW and GSMAP will cause a plot of data from the current database to be plotted on the screen. Lines and outlines of polygons will be plotted as lines; the position of symbols and letters (words) will be plotted as points, not as text entries. During the plotting on the screen, the process can be halted using the F9 key; it will resume after the F10 key is pressed.

Return to the Menu screen is invoked by striking any key after the screen plot is complete.

If the computer is in the graphics mode, a screen print can be made by simultaneously striking the Shift and PrtSc keys. Expect distortion.

PLOT ON THE HARD COPY PLOTTER

Selection of the plotting option - 9 - from the menu invokes a series of queries on the screen. Entries common to GSDRAW and GSMAP will be described first.

MAKE SURE THAT THE PLOTTER IS READY TO FUNCTION AND IS LOADED WITH PENS AND PAPER - if it isn't everything will come to a complete halt after you answer the first question !!!

The first question for each is :
DO YOU WANT TO USE A BATCH COMMAND FILE?(Y/N)
- Batch files contain answers to the on-screen queries from the computer during plotting, and should be used for complicated plots, plots that take a considerable amount of time, or for replicate plots. It works well to make the first plot of a diagram without using a batch command file, preserve the questions and answers by printing the screen, and write a command file using this set of answers as its contents. The contents of a batch command file for plotting will be described at the end of this section.

Both GSDRAW and GSMAP require entry of information that is needed to define the plot:
ENTER XOFF,YOFF:
- XOFF, and YOFF are "offsets", designed to allow moving the entire illustration to a new place on the plotting medium. The desired X offset and Y offset are entered in inches (and decimal inches) to position the illustration. X and Y are defined during digitizing; Y vertical and increasing from the lower left corner of the map, X horizontal, and increasing from the same corner. The offsets, X, Y, are entered, and separated by a comma.

DRAFT MODE(LABEL LINES W/LINE #) (Y,N):
- If "Y" is entered, the plot will be in draft mode, and the line number will be plotted to the left of the first digitized point for each line or other entry.
- If "N" is entered, these line numbers will not be plotted.

MAP SIZE(X,Y) No entry required: numbers will verify scale entered and will provide the size of the plot plus the offsets specified, for the X and Y dimensions.

Following this, wil be a query -
ROTATE (Y/N/Q)?
- The information requested relates to the way that the data will be plotted. The dimensions of the sheet in the plotter are not equal; with either 8 1/2" x 11" or 11"x17" sheets, the plotter"s X is the greater dimension. From the size of the plot provided by the computer, a choice must be made:
- "Q" should be specified if the dimensions of the requested plot do not fit the sheet size in the plotter, or if an error has been made in entry. This "Q" allows the process of specifing a plot to start over.
- "N" is appropriate if the plot size is correct, and the plot size for X)Y, or if the plot is small enough to fit even if X(Y.
- "Y" is appropriate if Y)X and the plot is too large to fit. The "rotate" command causes a rotation of the illustration of 90 degrees relative to the sheet in the plotter.

ENTER WIDTH,HEIGHT FOR LABEL CHARACTERS:
- This asks for specification of the size of the width and height of the characters which will be used as the labels of line numbers in draft mode; the size should be entered in inches (.1,.15 are good sizes to use, .069,.1 also work and are about the smallest size easily read using a relatively fine pen). This entry is needed whether draft mode is specified, or not.

Plotting in GSDRAW

The sequence of queries in GSDRAW is as follows:
"DO YOU WANT TO USE A BATCH COMMAND FILE?(Y/N):
- "N" will cause a series of requests for information to appear on the screen. Some of these have already been discussed, others will be covered here.

ENTER SCALE OF MAP TO BE PLOTTED(X,Y):
- Scale is entered in relation to the scale from which the illustration was first digitized using a multiplying factor -- 1,1 indicates a same size plot, .5,.5 a half size plot. X and Y may be different (to stretch or expand an illustration); the size of lettering is scaled to the X scale specified and is independent of the Y scale of the plot.

After all data defining the plot is entered, a series of queries will be made requesting data on entries to be plotted -
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE:
- The meaning of some of these entries will change, depending on the line code group invoked; see REFERENCE SECTION for details.

Ending a plotting session: 0,0,0,0
- A plotting session is ended by entering 0,0,0,0 in response to the request for SEG CODE,PEN,LINE TYPE,SYM TYPE: 0,0,0,0 induces

a return to the Menu.

A complete plot file in GSDRAW might look like this one (entries from the keyboard are printed in bold letters):

```
DO YOU WANT TO USE A BATCH COMMAND FILE?(Y/N) N
ENTER SCALE OF MAP TO BE PLOTTED(X,Y): 1,1
ENTER XOFF,YOFF: 1,2
DRAFT MODE(LABEL LINES W/LINE #)(Y/N): N
MAP SIZE(X,Y) 7.978001  11.9879
ROTATE (Y/N/Q)?Y
ENTER WIDTH,HEIGHT FOR LABEL CHARACTERS: .1,.15
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE: 400,1,0,0   (The meaning
ENTER FILL TYPE,SPACING,ANGLE: 0,50,0              of these
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE: 401,1,0,0   entries will
ENTER FILL TYPE,SPACING,ANGLE: 4,60,45             be given
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE: 500,1,0,0   later)
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE: 1,1,1,0
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE: 300,1,0,0
RANDOMIZE PATTERN(Y/N)? N
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE: 20,1,0,107
ENTER DELTA: .40
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE: 0,0,0,0
REPLOT SINGLE LINE? (Y/N)N
```

The corresponding plot file would be:

```
1,1
1,2
n
y
400,1,0,0
0,50,0
401,1,0,0
4,60,45
500,1,0,0
1,1,1,0
300,1,0,0
N
20,1,0,107
0,0,0,0
```

The answer to the REPLOT SINGLE LINE (Y/N) query must be supplied from the keyboard after the plot file instructions have been completed.

Plotting in GSMAP

The first question asked -
DO YOU WANT TO USE A BATCH FILE Y/N?
- "N" will cause questions to appear on the screen. Some of these have been discussed previously, the remaining questions will be covered here.

ENTER LAT/LON OF ___ CORNER OF PLOT AREA
- Entry of the latitude/longitude coordinates of each of the four corners of the plot area in degrees, minutes and seconds is needed, in the format requested -- numbers separated by commas.

ENTER SCALE OF MAP TO BE PLOTTED(X,Y):
- Entry is needed of the map scale in X and the scale in Y in a format providing the denominators of the scale fractions, separated by commas (ie. 24000,24000). Do not use extra commas. Separate X and Y scales are useful in fitting plots to base maps.

After all data defining the plot is entered, a series of requests will be made requesting the data on entries to be plotted -
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE:
- The meaning of some of these entries will change, depending on the line code group invoked; see REFERENCE SECTION for details.

Ending a plotting session: 0,0,0,0
- A plotting session is ended by entering 0,0,0,0 in response to the request for SEG CODE,PEN,LINE TYPE,SYM TYPE: 0,0,0,0 induces a return to the Menu.

A complete set for a plot might look like the one below (answers have been printed in bold letters):

```
ENTER LAT/LON OF NORTHWEST CORNER OF PLOT AREA
DD,MM,SS,DDD,MM,SS: 39,0,0,106,0,0
ENTER LAT/LON OF SOUTHWEST CORNER OF PLOT AREA
DD,MM,SS,DDD,MM,SS: 38,0,0,106,0,0
ENTER LAT/LON OF SOUTHEAST CORNER OF PLOT AREA
DD,MM,SS,DDD,MM,SS: 38,0,0,104,0,0
ENTER LAT/LON OF NORTHEAST CORNER OF PLOT AREA
DD,MM,SS,DDD,MM.SS: 39,0,0,104,0,0
ENTER SCALE OF MAP TO BE PLOTTED(X,Y):500000,500000
XSCALE=500000    YSCALE= 500000
ENTER XOFF,YOFF: 0,0
DRAFT MODE(LABEL LINES W/LINE #) (Y/N): N
MAP SIZE(X,Y) 13.8091277052541  8.77435074862034
ROTATE (Y/N/Q)?N
ENTER WIDTH,HEIGHT FOR LABEL CHARACTERS: .1,.15
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE: 1,4,0,0
ENTER SEG CODE,PEM,LINE TYPE,SYM TYPE: 2,1,0,0
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE: 3,1,0,0
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE: 300,4,0,0
RANDOMIZE PATTERN(Y/N)? N
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE:301,1,0,0
RANDOMIZE PATTERN(Y/N)? N
ENTER SEG CODE,PEN,LINE TYPE,SYM TYPE:0,0,0,0
```

(These do not have to be the corners that were digitized)

(The meaning of these entries will be summarized later)

The corresponding plot file would be:

```
39,0,0,106,0,0
38,0,0,106,0,0
38,0,0,104,0,0
39,0,0,104,0,0
500000,500000
0,0
N
N
1,4,0,0
2,1,0,0
3,1,0,0
300,4,0,0
N
301,1,0,0
N
0,0,0,0
```

MERGE ANOTHER DATA BASE - GSMAP ONLY

Entry of a 10 from the GSMAP Menu will invoke the following query -
ENTER NAME OF DATA BASE TO BE MERGED WITH CURRENT DATA BASE:
- This asks for the name of the database that is to be added (or "merged") with the one currently active. Just the name of the data base is to be entered, not file extensions. Entry of this data base name will cause the computer to add the data from the named database to the existing data in the one currently active. In this process, the line numbers of the "added" base are changed to become sequential with (and follow) those of the active base (to avoid duplication), and "deleted" lines are dropped.

The process of merging (adding) a data base may take several minutes; when the process is complete, the Menu screen will appear.

If you change your mind and do not want to add a database after starting the process, enter the word DONE, and you will return to the Menu screen.

EXIT

Entry of a 10 in GSDRAW or an 11 in GSMAP will end the session in these programs, and cause return to the DOS prompt.

REFERENCE SECTION - LINE CODES, DIGITIZING AND PLOTTING

GSDRAW and GSMAP utilize six line code groups, each with specific and different functions. Use of these line code groups is reviewed in the following section. As line codes are assigned during digitizing according to plot requirements, digitizing and plotting procedures are discussed together to facilitate comparison.

LINES AND DECORATED LINES - LINE CODES 1-99

Line codes 1-99 are assigned by the user to various kinds of lines; solid, dashed, dotted and combinations of dashes and dots, different line weights (different pens). Other line codes are assigned to lines decorated by various symbols, such as the triangle for thrust faults and the railroad track pattern for dikes. The available line types (plotter-defined patterns) are the following:

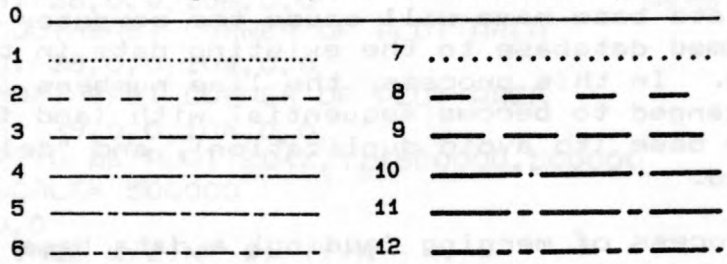


Figure 1

The "decorations" available that can be added to lines are shown below. The direction of digitizing is from left to right; this is important for symbols such as thrust faults for which the decoration is needed only on one side of the line.

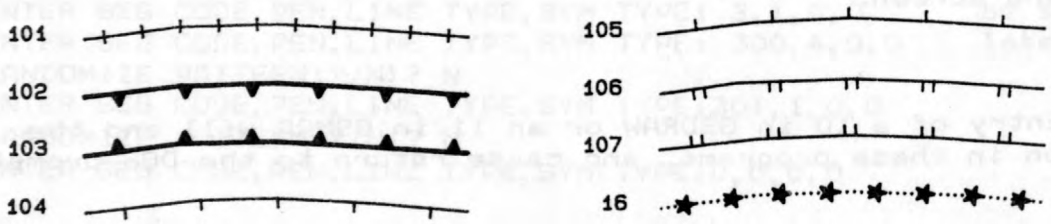


Figure 2. Numbers refer to entry in GSCAD.SYM file.

Any of the standard symbols from the file GSCAD.SYM can be added to a line during plotting, see symbol list shown under discussion of user defined symbols, line codes 300-399.

Digitizing

Three entries from the digitizer keyboard are required:

1. Line code: user defined, on the basis of the line desired --
   - line type, solid, dashed, dotted, etc. (fig.1)
   - line weight, contacts at .005", faults .015", etc.
   - line "decoration", triangles for thrust faults, etc.

following entry of the line code, "A" is used to complete the entry.

2. PARA 1: "A"
3. PARA 2: "A"

During entry from the keyboard, three tones will be sounded, C, F, and finally A (low, medium, high) to indicate that the system is ready to receive data points. Digitize the line using a series of "0" key entries until the last point. A "1" will end the line at the point indicated, a "2" will close the line by entering the point digitized and adding the first point digitized, thus closing the line.

Plotting

Plots of line codes 1-99 require a set of four entries from the computer; plots of decorated lines also require a second set to specify the spacing desired for decorating symbols.

The first set:

Entry 1: the line code specified (1-99) as defined by the user during digitizing

Entry 2: the pen number (1 through 8)

Entry 3: the line type; uses line types 0-12 as specified for the plotter (see fig. 1)

Entry 4: "0" for all normal lines; for thrusts and other "decorated" lines the appropriate symbol number should be used (GSCAD.SYM file)

The second set:

If Entry 4 is a number other than 0, the screen will request "ENTER DELTA SPACING:" this is the spacing between symbols that are used to decorate the line, measured in inches.

Notes:

- Use of some regular convention for common line types will aid digitizing and plotting. One convention easily remembered is to use line codes 1, 2, and 3 for narrow solid, dashed, and dotted lines (contacts), 4, 5, and 6 for heavy solid, dashed, and dotted lines (faults), and designate special lines such as area outlines or neat lines, starting with line code 10.
- A single line can contain no more than 500 points.
- If thrust faults are always digitized so that the "teeth" are on one side in the direction of digitizing, a single line code is needed, rather than two; plotting requires one less pass through the data.
- Experience will assist in answering the question "how many points ?". The factors to consider will include the curvature of the line, the kind of line (dotted lines require less points than solid lines), and the scale of the plot anticipated relative to the scale of the digitizing.
- Start and end lines at natural points, such as branches or intersections, just as a draftsman would. These minimize defects caused by pen starts and stops.
- Additions to the "decorations" used on decorated lines can be made in any part of table GSCAD.SYM and carry any number between 1 and 999.
- The size of the symbol used on the decorated line is 100 raster units; there is no way to change this size without coding a new smaller or larger symbol into the file GSCAD.SYM !
- The symbol on a decorated line will be rotated during plotting to preserve a constant angular relationship between the symbol and the line.

POSTING OF TABULAR DATA - LINE CODES 100-199

Line codes 100-199 are used to plot tabular data and symbols.

Data files must be organized as follows:

Locality number, value 1, value 2, value 3, etc.
- a table might look like the sample below: TEST.SAM contains a locality number column and four data columns (for four records)

```
410,   50,   10,   100,   200
411,   15,    2,    20,   200
414,   30,   50,   150,   200
416,   70,   10,   300,   500
```

A table like this can be created using a standard word processing program it must be ASCII

Digitizing

Three entries are required from the digitizer keypad:

1. Line code (100-199)
2. PARA 1: Locality number (any number containing up to 6 digits), and an "A" to complete entry if less than 6 digits)
3. PARA 2: "A"

During entry from the keypad three tones will sound, C, F, and finally A, to indicate that the computer is ready to receive a data point.

A "1" is used to digitize the point.

Plotting

Plots of line codes 100-199 require three sets of entries:

The first set:

Entry 1: Line code (100-199)

Entry 2: the pen number

Entry 3: the number of the symbol desired from file GSCAD.SYM

Entry 4: the size of the symbol desired (raster units, approximately 1/1000 inch per unit)

The second set:

ENTER FILENAME FOR TABLE - this asks for the name of the file containing the data to be plotted.

Entry 1: enter the complete name of the file, including extension.

The third set:

"# COLS, COL # TO PLOT"

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 column of data to be plotted, 2, the next, and so on.

Notes:

- Posting will always be done to the right of the symbol, with a space between the symbol and the left hand number equal to the symbol size specified for the plot.
- If a 0 is specified as the symbol requested, no symbol will be plotted, but the number from the table will be plotted in its normal place to the right of the digitized point.
- A plot of the data from the third data column in the table on the previous page, using symbol 8 might be specified as follows:

```
101,1,8,80   - 101 line code, pen 1, symbol 8, 80 rasters in size
TEST.SAM     - data in file named TEST.SAM
4,3          - 4 data columns, plot values from dat column 3
```

Its plot might be as in the example to the right:

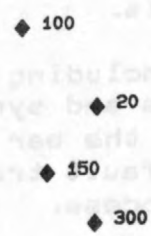


Figure 3

INDIVIDUALLY ROTATABLE SYMBOLS - LINE CODES 201-299

Line codes 200-299 are used for individually rotatable symbols. Symbols that are included in the standard table are the following:

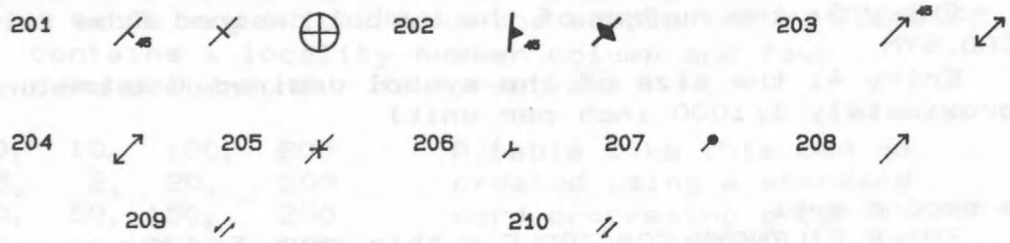


Figure 4

The angle of dip or plunge will be posted for symbols 201, 202, and 203. This capability is not easily available for other symbols.

Digitizing

Three entries from the digitizer keypad are required:

1. Line code: a line code is entered to select the desired symbol from the GSCAD.SYM file.
2. PARA 1: the angle of rotation of the symbol (degrees) in a clockwise direction, followed by an "A:
3. PARA 2: the angle of dip or plunge (degrees) to be posted, followed by "A". If no angle is required for the symbol chosen, enter "A"

During entry from the keypad three tones will sound, C, F, and finally A, indicating that the system is ready to receive data points.

The position of the symbol is entered using a "1" at the location desired. The rotation of the symbol during plotting uses this point as its axis.

Most symbols, including dip and strike, foliation, lineation, anticline arrows and syncline arrows rotate from the center of the symbol, but the bar and ball rotates from the end to be plotted on the fault trace -- each axis has been chosen to assist the drafting process.

Plotting

Plots of each symbol type, line codes 200-299, require one set of four entries from the keyboard.

Entry 1: the line code specifying the particular symbol type to be plotted
Entry 2: the pen number
Entry 3: 0
Entry 4: 0

Notes:
- The size of the symbol is set by the program and does not change with the scale of the plot.
- Fine tip pens must be used or the numbers that are posted will not be legible.
- Rotatable symbols that do not require posting of numbers can be added to the GSCAD.SYM table using unassigned numbers up to 299.
- Three different symbols are drawn for symbol type 201 - dip and strike, depending on the dip angle specified; these are the standard symbols for dip and strike, for vertical dip and for horizontal dip.
- Two different symbols are drawn for symbol type 202 - foliation, depending on dip angle specified; these are the standard foliation symbol and the vertical foliation symbol.
- Two different symbols are drawn for symbol type 203 - lineation, depending on the plunge angle specified; these are the standard arrow, and the double ended arrow for horizontal lineation.

USER-DEFINED SYMBOLS - LINE CODES 300-399

Line codes 300-399 are used for symbols (used-defined). The kind and size of the symbols can be individually specified; they can be rotated as a line code group, but not individually within a group, or their rotation can be "randomized", each differently rotated using a random number generator. Except for open and filled circles, the instructions to the plotter that define the symbol are contained in the file named GSCAD.SYM. Additions to this table are easily made. The following numbered symbols are in the standard table supplied with GSDRAW AND GSMAP, version 1.0:

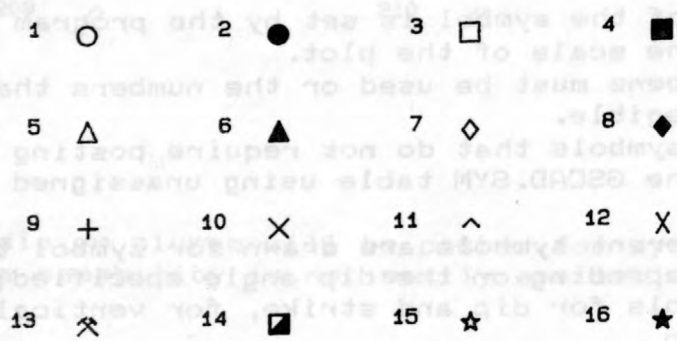


Figure 5

Digitizing

Three entries from the digitizer keypad are required:

1. Line code: user defined, on the basis of pen to be used, and rotation desired in plotting.
2. PARA 1: symbol number, (fig. 5)
3. PARA 2: symbol size (raster units, about 1/1000 inch)

During entry from the keypad, three tones will sound, C,F and finally A, indicating that the system is ready to receive data points.

If a single symbol is desired, a "1" is used. If a number of the same kind of symbol with the same size and rotation are desired, a series of "0"s are used, until the final entry, where a "1" should be used to end the entry.

Plots of symbols and symbol groups, line codes 300-399 require two sets of entries from the computer keyboard.

The first set:

Entry 1: the line code specified by the user when digitizing
Entry 2: pen number
Entry 3: 0
Entry 4: the angle in degrees (+ clockwise) that all symbols in a given line code are to be rotated, assuming that rotations are not to be randomized

The second set:

Entry 1: following these entries, the question "RANDOMIZE PATTERN (Y/N)?" is asked: an N will cause all symbols to be rotated the same amount (Entry 4 above); a Y will cause rotation based on a random number generator.

Notes:

- Although the random number generator is "random" in one sense, it always contains the same series of "random" numbers - like a printed random number table if you always start at the same place. Therefore, sequential plots will have the same symbols rotated to the same degree.
- If symbols in the GSCAD.SYM file are called using line codes 300-399 they are collectively rotatable, not individually rotatable.
- Filled and open circles (symbols 1 and 2) are coded into the main program, rather than being in the symbol table, to take advantage of plotter firmware and to draw better large circles.

POLYGONS AND FILLS - LINE CODES 400-499

Line codes 400-499 are used for closed polygons which are to be filled with a pattern that will be specified during plotting. The area is outlined as a closed area during digitizing. Fill types and the kind of line used for the outline are specified in the plotting process.

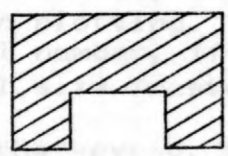
Digitizing

Three entries from the digitizer keypad are required:

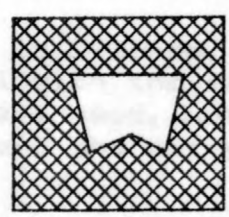
1. Line code: user defined, on the basis of fill required for the plot.
2. PARA 1: "A"
3. PARA 2: "A"

During entry from the keypad three tones will sound, C, F, and finally A, indicating that the system is ready to receive data points.

The outline of the polygon is digitized using a series of "0" key entries until the last point before closing. This last point is digitized either as a "2", which records the point and closes the polygon, or with a "3", which closes the external polygon, but leaves the entry open, for digitizing a single internal closed polygon which will not be filled. This internal polygon is digitized with a series of "0"s, closed with a "2", and when plotted will be left as an unfilled "window" inside the filled polygon.



Fill type 3, spacing 80, 30°



Fill type 4, spacing 60, 45°

Figure 6

Plots of filled polygons, line codes 400-499, require two sets of entries from the computer keyboard.

The standard four entries from the computer keyboard are required to specify line code, pen number, line type and symbol type; a second set of questions then ask for fill type, line spacing, and angle of rotation.

The first set:

Entry 1: the line code specified (between 400 and 499) as defined by the user when digitizing

Entry 2: pen number

Entry 3: line type, uses line types from 0-12 as specified for the plotter (see fig. 1)

Entry 4: 0 (decorated lines should not be used)

The second set:

Entry 1: fill type is a number from 1 to 4; it is defined by plotter firmware; specifying a 0 as fill type will cause the outline of the area to be drawn without fill.

1 -- solid fill, drawn by a pen with closely spaced parallel lines

2 -- solid fill, drawn by the pen with closely spaced parallel lines, then redrawn with closely spaced parallel lines that are perpendicular to the first set

3 -- a set of parallel lines filling the polygon

4 -- two sets of mutually perpendicular parallel lines (grid) filling the polygon

Entry 2: spacing, is entered in terms of raster units (1/1000 inch) and applies to the spacing between lines for fill types 3 and 4. For fill types 1 and 2, a default setting is used to attain a solid fill; enter any reasonable number (like 40) and the computer will ignore it to good effect.

Entry 3: angle, specifies the angle measured from the horizontal (+ counterclockwise, - clockwise) for the direction of the first set of lines drawn either as a solid fill or as spaced parallel lines.

Notes:

- Do not attempt to fill anything except a polygon that has been properly closed on digitizing; if you do, the results are more apt to be amusing than useful.
- The effect of a stipple pattern is obtained by using line type 1, and a spacing of about 30, or line type 7 and a spacing of about 60. The outline of the polygon is done with the same line type as that used in the fill.
- No more than 500 points can be used to define both exterior and interior polygons.

ALPHANUMERIC STUFF - WORDS, LETTERS, NUMBERS AND A FEW SPECIAL CHARACTERS

Line codes 500-599 are used for alphanumeric entries. The entities to be plotted are entered into a file labelled MAPNAME.RU (MAPNAME corresponds to the name of the file), and their position designated using information supplied to the computer during digitizing and plotting.

Choice of line codes is based on 1) pen type needed for plotting, 2) slant angle for letters (block letters or italics), and angle that the character, word, or block of text is to be entered on the page. Separate groups of text entries accordingly into different line codes.

Digitizing

Three entries from the digitizer keypad are required:

1. Line code: user defined on the basis of pen to be used and rotation desired in plotting, numbered between 500 and 599
2. PARA 1: the number of the entry to be placed on the plot corresponding to the number in the MAPNAME.RU file.
3. PARA 2: the size of the lettering, expressed in raster units (1/1000 inch); this assumes a 1:1 original:final plot scale.

During input of the three parameters from the keypad, three tones, C, F, and finally A will sound, indicating that the system is ready to receive data points.

The initial point, either a "0 or "1" on the keypad places the text block or symbol; the point is placed at the lower left corner of the first character in the block of text:

- If a "1" is used, the entry is complete
- If a "0" is used, the block of text is placed, and a succeeding "0" and "1" defines a straight-line leader between the positions of the two points, and completes the entry.
- After digitizing the point, the screen will show the position of the point, and any leader, but not the words or characters that will be plotted. No attempt has been made to show the characters because of the limited resolution of the screen.

Plotting

Four entries from the computer keyboard are required for line codes in the 500-599 series:

Entry 1: the line number (between 500 and 599)

Entry 2: pen number

Entry 3: slant angle of letter (an angle measured clockwise from the vertical; 0 degrees for block lettering, about 30 degrees for simulated italics.

Entry 4: angle of rotation of block of text on plot (an angle measured from the horizontal, + counterclockwise, - clockwise).

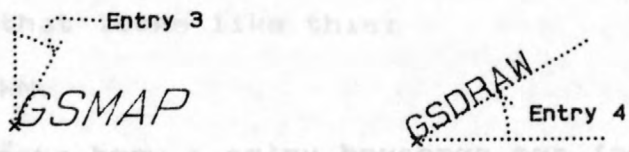


Figure 7

Notes:

- The block of text rotates around the initial digitized point during plotting.
- For GSDRAW the size of the lettering that will be plotted varies with the X scale of the plot, ie. a half-sized plot (as scaled in the X dimension) will have letters half the size of the raster size indicated during digitizing. The size is independent of the scale in Y.
- For GSMAP the size of the lettering will not be scaled according to plot scale; the size will remain as specified during digitizing.
- If a number is entered for digitizer Parameter 2 that does not correspond to an entry in the MAPNAME.RU file, no entry will be plotted, but the missing entry will be noted on the printer.

Word and character file - MAPNAME.RU

Words and symbols are typed into files in format for retrieval by GSDRAW AND GSMAP programs using line codes 500-599. The name of the file is MAPNAME.RU (MAPNAME is the name chosen for the files containing the illustration, RU stands for rock unit. In this file, the number is the label for the succeeding words , characters, or numbers which constitute the entry which will be plotted on the diagram. The number corresponds to Parameter 2 entered from the keyboard during digitizing. The "EOT" is the label marking the end of the entity to be plotted and must be placed on the line below this entity (EOT stands for 'end of text'). Commas are used to separate the three parts of the table entry.

Number, "Label",
"EOT"

The files (ASCII files) are prepared using a word processing program that does not leave imbedded characters (such as nondocument mode Wordstar) and must have a format like the example below (taken from a map explanation) -- there is no heading for the file.

```
1,"EXPLANATION",
"EOT"
2,"          Mississippi Valley-type lead-zinc deposits"
" "
"              Outline Iowa part of Upper Mississippi Valley
district"
"              Outline of mineralized subdistricts"
"              Outline of mineralized areas outside main
district"
" "
"              Bedded phosphate occurrences in basal Maquoketa Shale"
"EOT"
3,"0",
"EOT"
4,"5 MILES",
"EOT"
5,"1",
"EOT"
```

Special characters

Certain characters have been "redefined" so that they plot differently than they appear on the screen; these are of special use to geologists:

\	&	@	{	}	Keyboard
€	₱	₹	°	″	Plotted symbol

Figure 8

Notes on ___.RU files:

- A file that looks like this:

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

will plot as :

```
UNKNOWN                 -- because the 27," in front of the U is
RESOURCE                   not plotted, nor is the ", and "EOT"
POTENTIAL                  that follows -
```

- An easy way to set up a file in desired format, is to type all of the entities that will be plotted, then add the numbers, " marks, and "EOT" in the proper positions. The syntax of the file is very important. Characters or punctuation in the wrong place will cause problems during plotting.
- Quotation marks (") cannot be used in a label because they are a delimiter in BASIC. A substitute is provided by redefining the } character, as shown above.

CODING OF NEW SYMBOLS

New symbols can be coded by the user and included in the GSCAD.SYM file. The coding is easier than might be anticipated. Sketch a square of unit edge, with a point at the center. Begin specifying each symbol assuming that the pen is at the center point. Each line of the code tells the pen to move to a new position in the square; a "PU" specifies that the move is with the PEN UP (no line drawn), a "PD" specifies that the move is made with PEN DOWN (drawing a line). All moves are relative to the last point, not to the center of the square.

- The center of the square is the point that is digitized and the center of the plotted symbol.
- The first line of the symbol specifies the number assigned to the symbol, the number of moves, and if the polygon defined by the symbol is to be filled "Y", or is not to be filled "N".
- Each subsequent line begins with a "PU" or "PD" instruction, the move in the X direction, and the move in the Y direction.
- The pen need not be returned to the center point at the end of drawing the symbol.

EXAMPLE OF CODING OF USER DEFINED SYMBOL

```
209,6,"N"
"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 X
"PD",-0.1,0.2
```

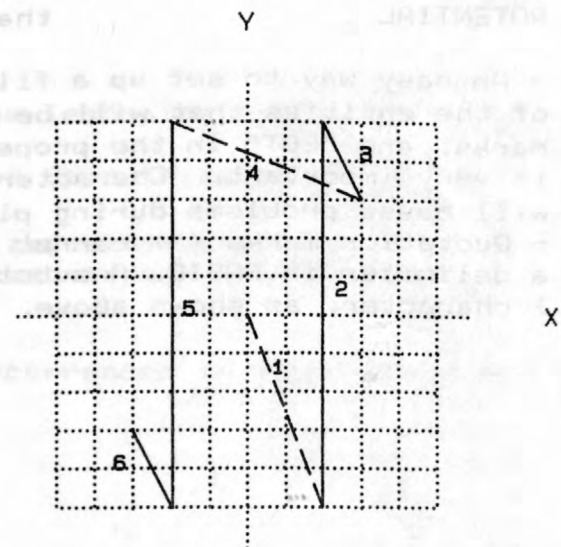


Figure 9

PLANNING - THE DIRECT ROUTE BETWEEN DIGITIZING AND PLOTTING

The process of creating a finished illustration can be greatly speeded up by planning the digitizing session so that plotting can be accomplished with the fewest changes. This requires understanding the functions of the six line code groups, and early decisions as to the line codes which are to be used.

A good way to start is by sorting the kinds of lines that are to be plotted, line codes 1-99. One convention previously suggested is for line codes 1, 2, and 3 to be used for fine (narrow) solid, dashed, and dotted lines, 4, 5, and 6 to be used for wider solid, dashed, and dotted lines; similarly, other line codes should be reserved for other requirements. These assignments should be written down for reference during digitizing and plotting.

Next, needs for 100-199 line codes for data to be plotted should be considered, and data tables created in proper format. A printout of the data table will aid digitizing, and enable checks after plotting.

Next, needs for line codes 200-299 should be identified, and lists of symbols and their numbers prepared.

Next, needs for other symbols, line codes 300-399 should be identified and a list prepared with symbol type and number, and assigned line code.

Next, entries requiring closed polygons, line codes 400-499, should be identified and listed with an assigned line code. This list may also include an indication of the fill type that will be desired in plotting.

Finally, line codes 500-599 should be considered. Line codes should be assigned based on plot requirements; one convention starts with line code 500 assigned to horizontal letters and words drawn in block letters with a fine pen, 501 for words to be written vertically in block letters with a fine pen, and uses line codes 510 and up for specific entries requiring special angles of entry. At this time, the MAPNAME.RU file should be prepared, in proper format, and a printout prepared for reference during digitizing.

The planning steps above will reduce the time spent on the digitizer, and help in doing the job right the first time. Although full edit capability is built into both GSMAP and GSDRAW, the less edit required, the better.

We suggest that at the conclusion of digitizing the entire illustration be plotted in draft mode so that the line numbers for each entry can be identified. For complex illustrations, separate plots with only a few line codes on each plot may assist both proof reading and identification of problem entries. Use of color pens also aids in identification of line numbers associated with particular entries.

If the first plot is made in interactive mode, i.e. without a plot file, the prograp will create onscreen a complete record of the entries needed for the plot file; a screen print will provide a complete record of the process. Plot files are strongly recommended for complex illustrations and final plots. They help "standardize" the illustration for replicate illustrations and avoid errors of entry in the plotting process.

Instructions included with the plotter provide guidance to aid selection of plotting media. We suggest using fibre-tipped pens and paper for preliminary plots, and reserving drafting pens and mylar for final versions.

Appendix 1. Installation instructions

HARDWARE

The computer, digitizer, and plotter installation generally coincide with the instructions which come with each piece of equipment. The following notes are included to help with some of the choices that must be made during hardware installation:

1. The plotter must be connected to serial port #1 (COM1:) and the digitizer must be connected to serial port #2 (COM2:). If other serial devices are connected to the system, they may share one of the serial ports via a T-switch.

2. The printer must be connected to parallel port #1 (LPT1:).

3. The HP-7550A plotter should be set up following the instructions found in "Operation and Interconnection Manual", which comes with the plotter (p.6-25 for an IBM PC). Note that to make the BASIC program shown on p.6-26 (of the same manual) work, the following statement needs to be substituted:

```
10 OPEN "COM1:9600,N,8,1,RS,CS65535,DS,CD" AS #1
```

4. For other plotters in the HP-7500 series, follow the instructions in the appropriate interconnection manual to set the plotter for the following parameters:

Remote
Standalone
Handshake: hardwire
Direct
Duplex: full
Parity: off
Data bits: 8
Stop bits: 1
Rate: 9600 baud

5. 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 (cable diagram is shown in the "User's Manual", Appendix on RS-232 interfacing, fig. 1, DTE-to-DTE cabling). The following switch settings are used (switches on bottom of digitizer.

	1	2	3	4	5	6	7	8
S1	1	1	1	0	0	0	0	1
S2	1	1	1	0	1	0	0	0
S3	0	1	1	0	1	0	0	0

1 = ON
0 = OFF

SOFTWARE

The release diskette contains the executable copies of GSDRAW and GSMAP. These files (GSDRAW.EXE and GSMAP.EXE) can be placed in any convenient place the user desires. The symbol file (GSCAD.SYM) must be resident in the default device and directory. It is strongly recommended that the release diskette be copied onto a backup diskette prior to any usage.