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GEOLOGICAL SURVEY OF CANADA

# ISAMAP USER'S MANUAL

## An Interpolation and Contouring Package for Continuous Phenomena

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# ISAMAP USER'S MANUAL

## INTRODUCTION

The software package ISAMAP (Isarithmic Mapping) has been developed to draw contour maps from scattered data points (control points) for use as basic documents in urban geological studies. The main objectives in designing the package were to produce accurate representations of continuous phenomena with reasonable cartographic quality and to provide an efficient yet flexible system.

In contrast to available general purpose contouring programs, ISAMAP uses strictly an interpolation algorithm (vs. extrapolation beyond known values) to generate the contour lines, and offers only a limited number of basic display options. The package is of modular design, however, and thus allows any part of it to be modified or replaced by a user with minimum programing experience. The modular approach permits flexibility in adapting the package to individual needs and also realizes savings in computer time and memory.

This manual includes a general description of the system, a short discussion of the interpolation algorithm, and a user's guide. A listing of the programs can be obtained from the Urban Geology unit of the Geological Survey of Canada.

# CHAPTER I

## GENERAL DESCRIPTION

The package is divided into three independent phases or modules: input, interpolation, and cartography (Fig. 1).

The input phase reads the X-Y co-ordinates and Z values of the data points and arranges them on the basis of ascending values of the X co-ordinates. The input data can be located on computer punched cards, magnetic tapes, discs, or any other computer devices, and can be in any format. Once the information is read and sorted, the program stores the pertinent values on a temporary on-line file for further processing. The data points are sorted to optimize the search for points surrounding each interpolated point (grid point), and to help the grouping of overlying data points.

The second phase, interpolation program, generates a regular grid of interpolated values from the irregularly spaced data points, according to the user's specifications. Figure 2 shows the function of the interpolation program.

The third phase, cartography, generates the contour lines and draws the legend.

Any phase can be replaced by a user program to perform different types of processing (i.e. different interpolation algorithm), and any subroutine, which represents one of several steps in each phase, can be modified or replaced by a user's subroutine.

The package operates on a Control Data CYBER 74 computer; an EAI 430 Data Plotter is used to draw the maps. All programs are written in Fortran IV extended and the sorting of the input data is done through the Sort-Merge facility.

# ISAMAP PACKAGE STRUCTURE

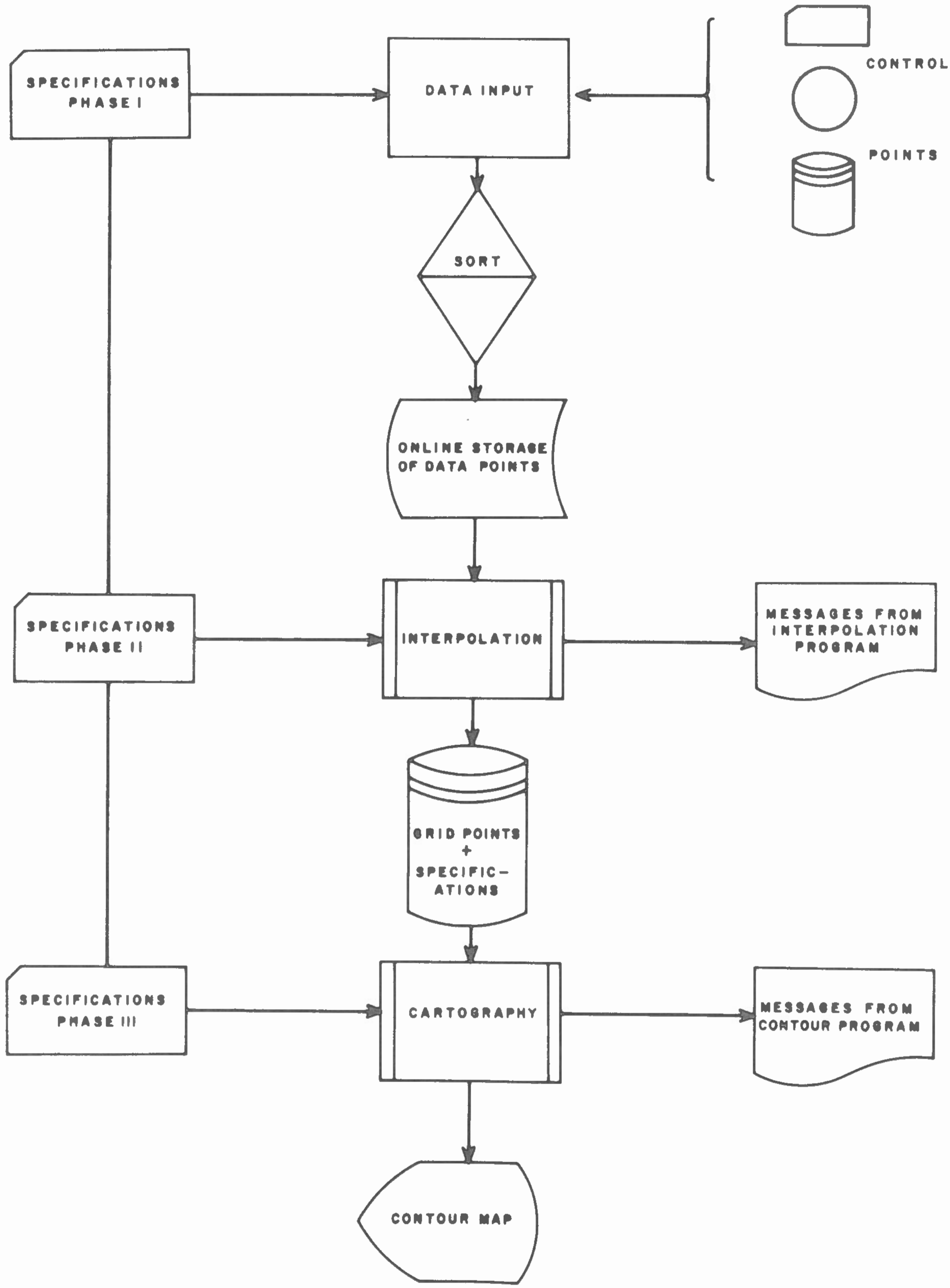



FIGURE I

## INTERPOLATION ALGORITHM

The algorithm used to generate the grid values from the scattered data points is strictly an interpolation one. That is, no grid point is assigned a value beyond the surrounding maximum Z values. The reason for using an interpolation algorithm rather than one that generates values based on the slope of the surrounding plane, is to produce documents with a relatively "conservative" aspect. This characteristic is important in Urban Geology in order to minimize the risks of over-emphasizing phenomena of importance in land use planning.

## Selecting the Control Points

Each grid point is evaluated from the surrounding control points. The search area either can be specified by the user or can be assigned automatically by the program. A minimum and maximum limit can be placed on the number of data points to be considered.

The search for control points is done in the X and Y directions independently (rectangular search), rather than a circular search, to permit the user to orient the search.

When the area is not specified, the program calculates a standard search area, based on the density of the control points, in which an average number (specified or calculated) of data points should be found. If less than the specified number of points is found the area is enlarged; if an excess number of data points falls inside the search area only those closest to the grid point are used. The program allows a maximum of twenty control points and a minimum of one to be used for the interpolation.

## Influence of Distance

The second factor taken into consideration in interpolation is distance. It is obvious that the points located farther from the grid point should have less influence on it than data points closer. Although the most unbiased approach is to give a weight factor inversely proportional to the distance, an inverse squared distance is used. This overcomes the problem that occurs when a simple inverse distance is used of having sharp variations near control points.

## Shadow Zones

To overcome the problems caused by clustered control points located in the vicinity of the values to be interpolated, a shadow zone is created behind each data point from the grid point (Fig. 3). The influence of a

INTERPOLATION TO OBTAIN A REGULAR GRID

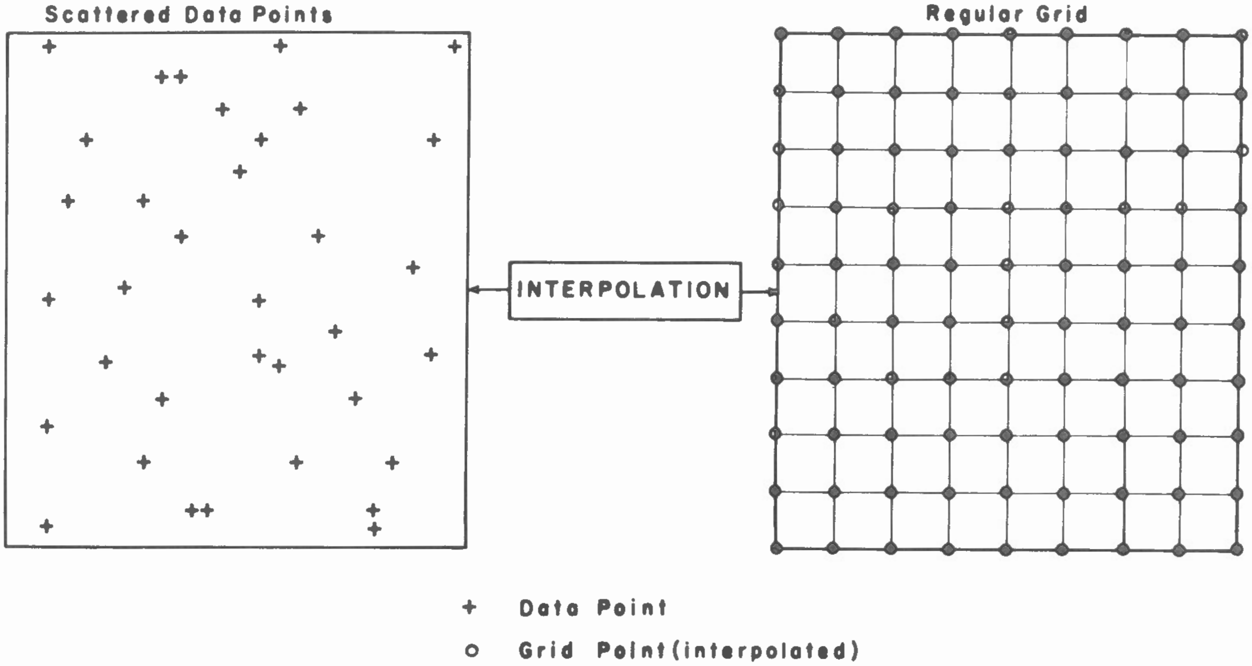



FIGURE 2

SHADOW ZONE CREATED BY CLOSER POINTS

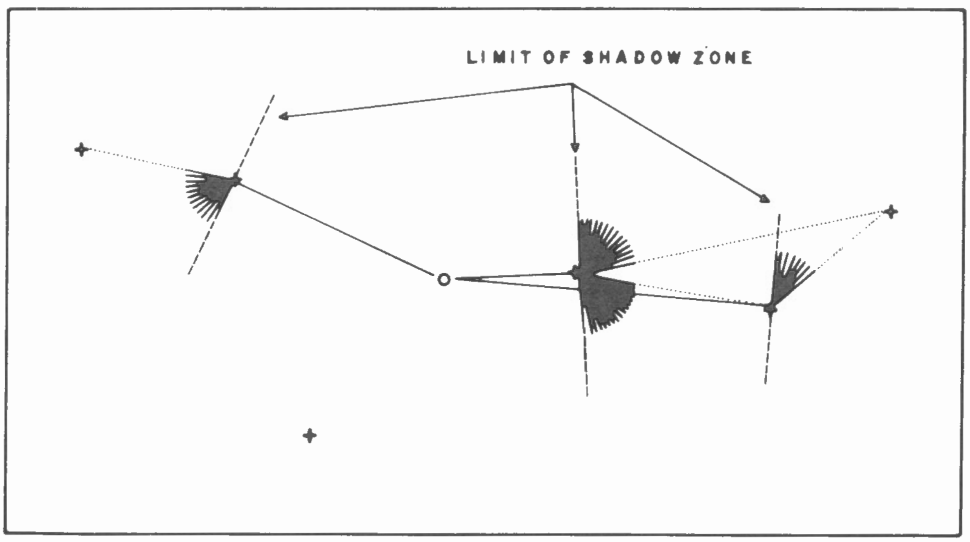



FIGURE 3

data point that falls in the shadow zone of another data point is reduced as shown in Figure 4. The positional factor is defined by the cosine of angle $P_0$, $P_1$, $P_2$ (Fig. 4). A screening effect is essential in the present algorithm since no slope factor is taken into consideration to overcome the shortcoming of a straight inverse distance interpolation (Fig. 5).

INCREMENTAL EFFECT OF THE SHADOW ZONE

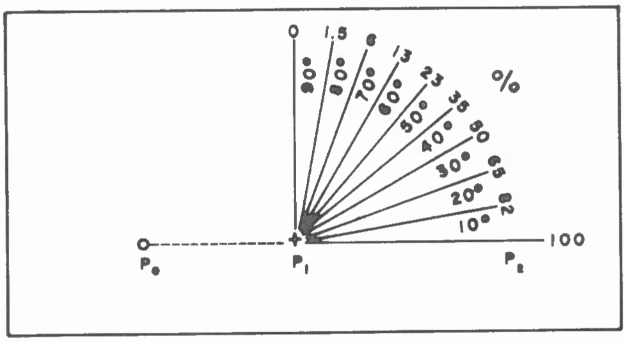



FIGURE 4

NECESSITY OF A SHADOW ZONE

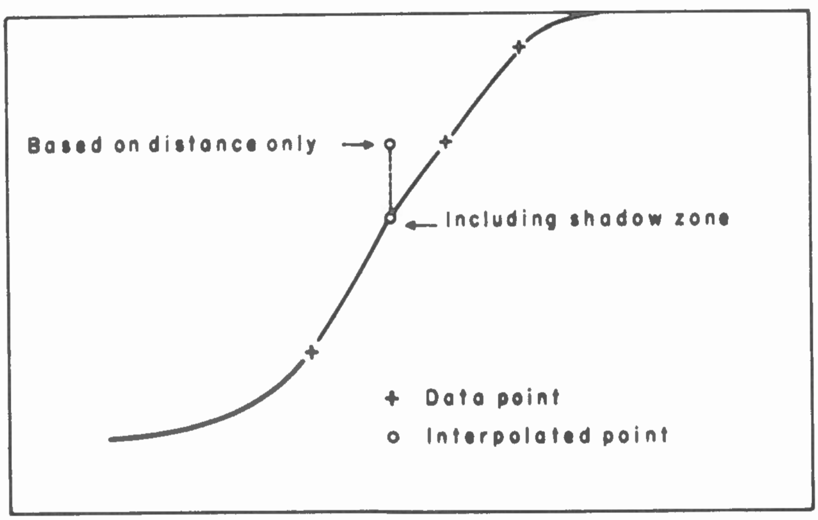



FIGURE 5

## CONTOUR LINE GENERATION

The contouring program reads the interpolated grid points and draws the contour lines and the legend.

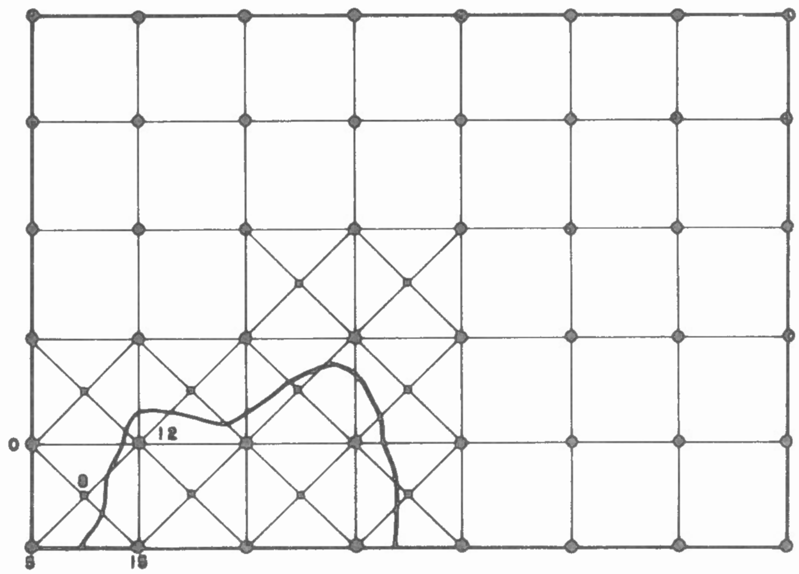
The gridded surface first is subdivided into triangles by joining the four corners of the rectangles formed by the grid points (Fig. 6). The centre point formed by the intersection of the diagonals is interpolated as the average of the four corner points.

The second step is to find the beginning of the contour line by linear interpolation between grid points, first along the edges of the map and then throughout the entire area. Once a value equal to the contour line is found, the contour line is "followed" by searching in adjoining triangles. When the line crosses a boundary or reaches its point of origin to form a closed contour line, the process is repeated to find the next contour line. When a sufficient number of points along the line are found, or when the contour ends, the line is drawn and annotated as specified by the user.

## LEGEND

The user has a number of options for the drawing of a legend on the map. The standard options are described in the input cards for the contouring phase. A typical use of those options is given in Chapter III. The user also can supply his own subroutine to draw any type of legend not offered as a standard option. The parameters required for the subroutine are given in Chapter III.

CONTOUR GENERATION




• Interpolated point

o Grid point

~ Contour line, Value = 10

FIGURE 6

# CHAPTER II

## SPECIFICATION CARDS FOR PHASE I: INPUT-SORT

If the user supplies his own grid points, the specification cards for Phase I should be omitted.

The format of the specification cards is divided into two fields: identification and specification. The identification parameter helps the user in placing the cards in the proper sequence, prevents the entry of improper parameters, facilitates the reference to existing decks. The sequence of the cards should conform to the sequence number appearing in column 1 of each card.

### Format card

Purpose: To describe the format of the file containing the data points.

Identification: 1-FORMAT column 1-8

Format: The format specification consists of a FORTRAN type description enclosed in parentheses, without the word FORMAT or the statement label. The format description starts in column 11.

Comments:
- The X-Y-Z variables should be specified as real values on the format card but the input data can be integer variables right justified.
- If the data input cards contain information other than the X-Y-Z parameters, the information should be specified as blank fields (i.e. X-format).
- If the information is unformatted, i.e. binary, the word "UNFORMATTED" should be written starting in column 1.

## Sequence Card

Purpose: To specify the order of the X-Y-Z values on the data cards.

Identification: 2-SEQUENCE column 1-10

Format:

| Column | Information | Format |
|---|---|---|
| 20 | Position of X value | I1 |
| 21 | Position of Y value | I1 |
| 22 | Position of Z value | I1 |

## Data Cards

Purpose: To supply the X-Y-Z values of the data points.

Identification: No identification

Format: Specified by the user on the FORMAT card.

Comments: If the data points are not supplied on punched cards, the program automatically will search the file called TAPE 5. An ATTACH card describing the input file should be included when the data points are stored on TAPE 5 (see Ch. III, Card Deck Layout).

## SPECIFICATION CARDS FOR PHASE II: INTERPOLATION

Every card must be included, even if the user wishes to make use of default values.

Figure 7 identifies the parameters on the map.

### Map Borders

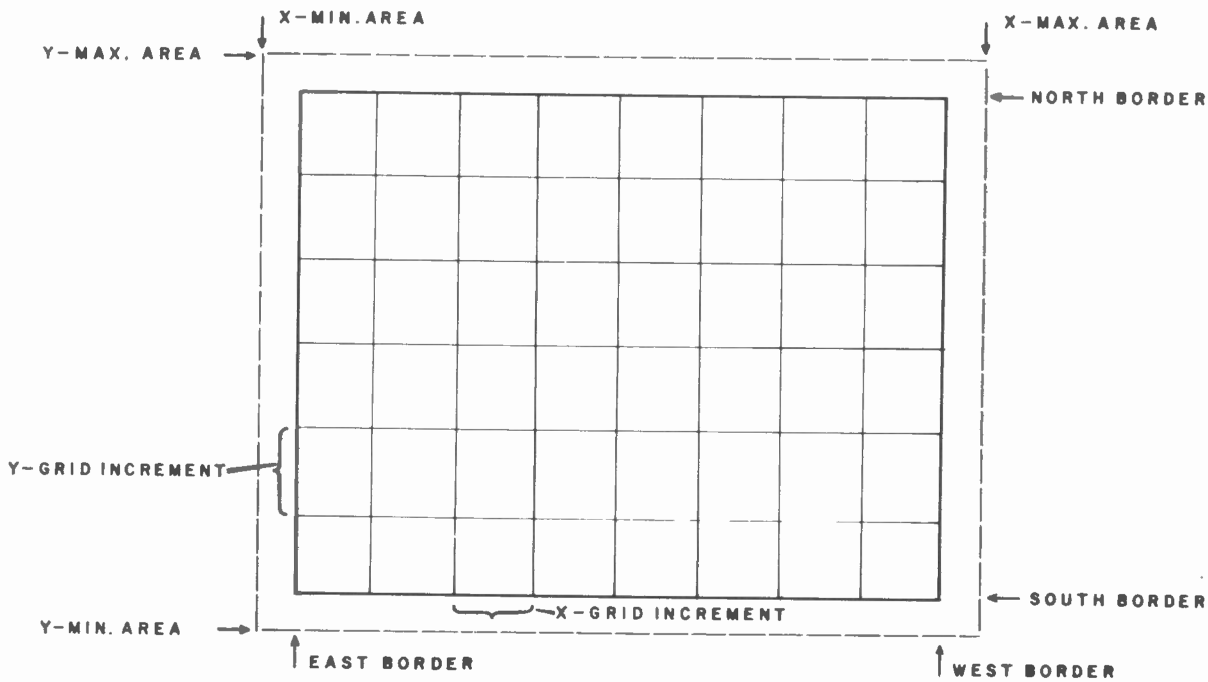
Purpose: To define the limits of the contouring area.

Identification: 1-BORDERS column 1-9

Format:

| Column | Information | Format |
|---|---|---|
| 11-20 | X-minimum (east border) | F10.0 |
| 21-30 | X-maximum (west border) | F10.0 |
| 31-40 | Y-minimum (south border) | F10.0 |
| 41-50 | Y-maximum (north border) | F10.0 |

Comments: All values are given in user's units.




IDENTIFICATION OF THE PARAMETERS
FIGURE 7

## Area Containing the Control Points

Purpose: To specify the limits of the area containing the control points for the interpolation.

Identification: 2-AREA column 1-6

Format:

| Column | Information | Format |
|---|---|---|
| 11-20 | X-minimum (east) | F10.0 |
| 21-30 | X-maximum (west) | F10.0 |
| 31-40 | Y-minimum (south) | F10.0 |
| 41-50 | Y-maximum (north) | F10.0 |

Comments:

- The values are in user's units.
- The area containing the control points can be larger or smaller than the contouring area.
- It is preferable to have the area containing data points larger than the contouring area to improve the interpolation at the map edges.

## Increments for Grid Points

Purpose: To specify the spacing between the interpolated points (grid points).

Identification: 3-GRID column 1-6

Format:

| Column | Information | Format |
|---|---|---|
| 11-20 | Spacing in X direction | F10.0 |
| 21-30 | Spacing in Y direction | F10.0 |
| 31-40 | Minimum distance | F10.0 |

Comments:

- If the user does not specify the spacing between the grid points, the program calculates a default value based on the density of the control points (approximately four times the density of data points).
- When the cumulated increments do not fit the map area exactly, the spacing of the grid points is modified.
- The distance specified in column 31-40 is the minimum distance accepted between a data point and a grid point. If the distance is less than the one specified, the two points are considered as overlying and the grid point will be given the value of the control point. When the distance is not specified the program assigns a value of approximately one eighth the grid distance.

## Search Area

Purpose: To specify the initial search area around each grid point in order to find sufficient data points for the interpolation. The user also can specify the minimum distance accepted between data points.

Identification: 4-SEARCH column 1-8

Format:

| Column | Information | Format |
|---|---|---|
| 11-20 | Search distance in X direction | F10.0 |
| 21-30 | Search distance in Y direction | F10.0 |
| 31-40 | Minimum distance accepted between data points | F10.0 |
| 50 | If set to "1" the grouped data points are listed | I1 |

Comments:

- The search distance is the distance on each side of the grid point. The search area therefore is twice the dimensions specified by the user.
- If the minimum distance between data points is not specified, the program uses approximately one eighth of the distance between grid points.
- When two data points are closer than the accepted minimum distance, the X, Y, and Z values are averaged to form only one data point.

## Number of Data Points

| | | | |
|---|---|---|---|
| Purpose: | To specify the minumum and maximum number of data points used to interpolate the grid points. | | |
| Identification: | 5-NUMBER column 1-8 | | |
| Format: | Column | Information | Format |
| | 19-20 | Minimum number | I2 |
| | 29-30 | Maximum number | I2 |
| Comments: | - The default values generated by the program are a minimum of 4 and a maximum of 9. | | |
| | - Minimum and maximum values permitted are 2 and 20. | | |

## SPECIFICATION CARDS FOR PHASE III: CONTOUR AND LEGEND

### Contour Interval

Purpose: To specify the value of the contour lines. The user can specify each contour value or have the contour lines drawn at regular intervals.

Identification: 1-INTERVAL column 1-10

#### Regular Interval

Format:

| Column | Information | Format |
|---|---|---|
| 21-27 | REGULAR | A7 |
| 31-35 | Contour interval | I5 |
| 41-50 | Minimum value of contour | I10 |
| 61-70 | Maximum value of contour | I10 |

Comments: - If the user does not specify the minimum or maximum value of the contour line, the program will use the minimum and maximum supplied by the grid points.

- The default value for the contour interval is 1/13 of the total range, i.e. (max-min)÷13.

#### Contour lines specified

Format:

| Column | Information | Format |
|---|---|---|
| 21-30 | SPECIFIED | A10 |
| 35-56 | Number of contours | I2 |
| Following cards, maximum or 40 | | |
| 11-20 | Contour value | I10 |

## Labelled Contours

Purpose: To specify the contour lines that will be identified on the map. The user can specify each contour line to be labelled or have the lines labelled at regular intervals.

Identification: 2-LABEL column 1-7

### Regular interval

Format:

| Column | Information | Format |
|---|---|---|
| 21-27 | REGULAR | A7 |
| 41-42 | Interval at which the contour will be labelled | I2 |

Comments: Regular interval means that every $n^{th}$ line will be labelled. The default value is every fifth line to be labelled.

### Labels specified

Format:

| Column | Information | Format |
|---|---|---|
| 21-30 | SPECIFIED | A9 |
| 35-36 | Number of labels specified | I2 |
| Following cards, maximum of 40 | | |
| 11-21 | Label value | I10 |

## Scale of Output Map

Purpose: To specify the scale of the output map and the units of measurement used.

Identification: 3-SCALE column 1-7

Format:

| Column | Information | Format |
|---|---|---|
| 20-30 | Scale of map | F11.0 |
| 40... | Units of measurement (input) | |
| | INCHES or | A6 |
| | CENTIMETRE or | A10 |
| | UTM (metres) | A3 |
| 60-70 | Scaling factor, if units of measurement are other than above, to change the input units into plot inches | F11.0 |

Comments:

- All the input units will be divided by the scaling factor specified in column 60-70.
- If, for example, the input units are in feet, the scaling factor would be 12 and the units would be changed to inches.

## Type of Base Map

Purpose: To specify the type of base map that will be used to produce the map. The base can be blank or the user can provide his own base on which a legend is already printed (eg. N.T.S. base map). If the user wishes to use a printed base, two reference points (in user's units) are required to centre the map on the plotter table.

Identification: 4-BASE MAP column 1-10

### Blank Base Map

Format:

| Column | Information | Format |
|---|---|---|
| 20-24 | BLANK | A5 |

### Printed Base Map

Format:

| Column | Information | Format |
|---|---|---|
| 20-26 | PRINTED | A7 |
| 31-40 | X co-ordinate of first point | F10.0 |
| 41-50 | Y co-ordinate of first point | F10.0 |
| 51-60 | X co-ordinate of second point | F10.0 |
| 61-70 | Y co-ordinate of second point | F10.0 |

## Posting of Data Points

Purpose: To print data points on the map.

Identification: 5-POST column 1-6

Format:

| Column | Information | Format |
|---|---|---|
| 15 | 0 = do not post<br>1 = post a + mark on the location<br>2 = post the value only, the first digit will be centred on the exact location<br>3 = post a + on the location and the value below | I1 |

## Blank Area

Purpose: To delete the contour lines from certain areas of the map.

Identification: 6-BLANK column 1-7

Format:

| Column | Information | Format |
|---|---|---|
| 20-22 | Number of vertices in the polygon forming the area | I2 |
| Following cards, minimum 3 and maximum 100 | | |
| 11-20 | X co-ordinate | F10.0 |
| 21-30 | Y co-ordinate | F10.0 |

Comments: The co-ordinates of the blank area can be specified in a clockwise or counter-clockwise order.

## Instructions for Plotter Operator

Purpose: To specify instructions to the plotter operator to produce the map. These instructions will be printed in the lower margin of the map at the beginning of the plot.

Identification: 7-INSTRUCT column 1-10

Format:

| Column | Information | Format |
|---|---|---|
| 20 | Number of cards containing the instructions | I1 |
| Following cards, maximum of 3 cards | | |
| 1-80 | Instructions for the operator | 8A10 |

## Specifications for the Legend

If the user wishes to have any legend other than the standard ones, a user's subroutine can be included between the information cards for Phase I and Phase II. The specifications for the user's subroutine are given in the section on User's Subroutine.

Purpose: The user can specify any of the following options to annotate the map. Some options can be repeated.

Identification: 8-LEGEND column 1-8

### Title of the map

Purpose: To have a title written in the section reserved for the legend.

Format:

| Column | Information | Format |
|---|---|---|
| 1-7 | 1-TITLE | A7 |
| 11-80 | Text to be scribed on the map | 7A10 |

Comments:

- A maximum of 3 titles can be specified.
- A new title card should be used for each title.
- The text has to be left justified on the card to be centred on the map.

<u>Subtitle</u>

Purpose: To have a subtitle written on the map.

Format:

| Column | Information | Format |
|---|---|---|
| 1-10 | 2-SUBTITLE | A10 |
| 11-80 | Text to be scribed on the map | 7A10 |

Comments:

- A maximum of 3 subtitles can be specified.
- A new subtitle card should be used for each subtitle.
- The text for the subtitle should be left justified on the card to be centred on the map.

<u>Legend</u>

| | | | |
|---|---|---|---|
| Purpose: | To have a legend printed on the map. | | |
| Format: | Column | Information | Format |
| | 1-8 | 3-LEGEND | A8 |
| | 11-80 | Text for legend | 7A10 |

Comments:

- A maximum of 6 legend cards can be included.
- A new legend card should be used for each legend.
- The text should be left justified on the card to be centred on the map.

Scale

Purpose: To have the scale of the output map written or drawn as a legend.

Format:

| Column | Information | Format |
|---|---|---|
| 1-7 | 4-SCALE | A7 |
| 11-15 | DRAWN - the scale will be drawn | A5 |
| 11-15 | RATIO = the scale will be written as a fraction | A5 |
| 11-14 | BOTH = the scale will be written and drawn | A4 |

Comments: - If the scale of the map is larger than 1:10,000 the scale will be written only.

- The scale appearing in the legend is the one specified on the card 3-SCALE, column 20-30.

Border and co-ordinates identification

Purpose: To have an outside border drawn around the entire map, to have the co-ordinates identified in the margins and to have a grid drawn on the map, corresponding to the co-ordinates.

Format:

| Column | Information | Format |
|---|---|---|
| 1-8 | 5-BORDER | A8 |
| 11-20 | Interval at which the co-ordinates will be identified. | I10 |
| 30 | Should be set to 1 if a grid is to be drawn on the map. | A1 |

User's name

Purpose: To have the user's name printed in the lower right corner of the area used for the legend.

Format:

| Column | Information | Format |
|---|---|---|
| 1-4 | 6-ID | A4 |
| 11-30 | User's name | 2A10 |

User's subroutine

Purpose: To indicate that the user has supplied his own subroutine to write or draw a legend.

Format:

| Column | Information | Format |
|---|---|---|
| 1-12 | 7-SUBROUTINE | A10, A2 |

Comments: - The subroutine is inserted between the specifications for Phase II and Phase III.

Name of subroutine: ANOT

The user can communicate with the calling program through labelled common blocks.

COMMON/EGRAPH/ XPAR (20), YPAR (20)

This common block refers to the plotter subroutines. Refer to the EAI 430/100 Data Plotter Manual.

COMMON/SPECF/BORDER(4), DUMMY (4), SCALE

BORDER 1 to 4 refer to the borders of the map, see 1-BORDERS card.

DUMMY: dummy arguments, they should not be changed.

SCALE: value by which all user's units must be divided to be changed to the plotter's units.

## CHAPTER III

## CARD DECK LAYOUT

| | Comments |
|---|---|
| D1234,Cm.....,T....,P.,MT. | MT1 if a plotter tape is requested |
| ACCOUNT,.... | |
| REQUEST,GSCPLOT,S,SV. YOUR NAME | Request for a plotter tape |
| ATTACH,TAPE5,...... | Used only if the data points are on a file other than punched cards |
| ATTACH,TAPE6,...... | Used only if the user supplies his own grid points |
| ATTACH,CONTROL,ISMAP,ID=JRB. | |
| XQT. | |
| CATALOG,TAPE8,...... | Used only if the interpolated grid points are to be stored |
| $^{7}8_{9}$ | |
| Specification cards for Phase I | Omitted if the user supplies his own grid points |
| $^{7}8_{9}$ | Must be included |
| Specification cards for Phase II | Every card must be included |
| $^{7}8_{9}$ | |
| User's subroutine | Optional |
| $^{7}8_{9}$ | Must be included |
| Specification cards for Phase III | Every card must be included, except for legend |
| $^{6}{}^{7}8_{9}$ | |

## CENTRAL MEMORY AND C.P.U. TIME

The figures quoted below show the central memory requirements and C.P.U. times in each phase of the package for several different maps. These amounts obviously vary depending on the number of data points, distribution of data points, size of the grid used, number of contours required, use of the legend, etc. Thus Table 1 is intended to provide a basis from which initial estimates may be made.

Table 1

| Phase | Control Points | Interpolated Points | Contour Lines | C.P.* | C.M. |
|---|---|---|---|---|---|
| Input-sort and Interpolation | 4 | 4 | | .098 | 46 K |
| | 221 | 1156 | | 6.69 | 47 K |
| | 221 | 3364 | | 17.68 | 47 K |
| | 1260 | 4761 | | 30.20 | 55 K |
| Contouring | | 4 | 1 | 1.09 | 70 K |
| | | 1156 | 6 | 2.32 | 76 K |
| | | 1156 | 11 | 3.42 | 76 K |
| | | 3364 | 11 | 5.32 | 110 K |
| | | 4761 | 13 | 13.06 | 120 K |

* Execution time, add 9 seconds for total time.

## GRID POINT FILE DESCRIPTION

The ISAMAP package permits the use of the contour phase only if the user supplies his own interpolated points. When using the contour program only, the following points should be observed:

- The file containing the information should be: TAPE6
- The information is unformatted
- The first record on the file supplies the following information:
    - left border (real number)
    - right border (real number)
    - south border (real number)
    - north border (real number)
    - number of grid points in X direction (integer number)
    - number of grid points in Y direction (integer number)
    - increment for grid points in X direction (real number)
    - increment for grid points in Y direction (real number)
    - Z value minimum (real value)
    - Z value maximum (real value)
    - number of data points (integer number)
- The second set of records contains the data points, if any, to be put on the map. Each record contains the X, Y, Z values in the user's unit.
- The third set of records contains the grid values. Each value forms one record (unformatted). The first grid point should correspond to the lower left corner of the map and should progress row by row up to the upper right corner.

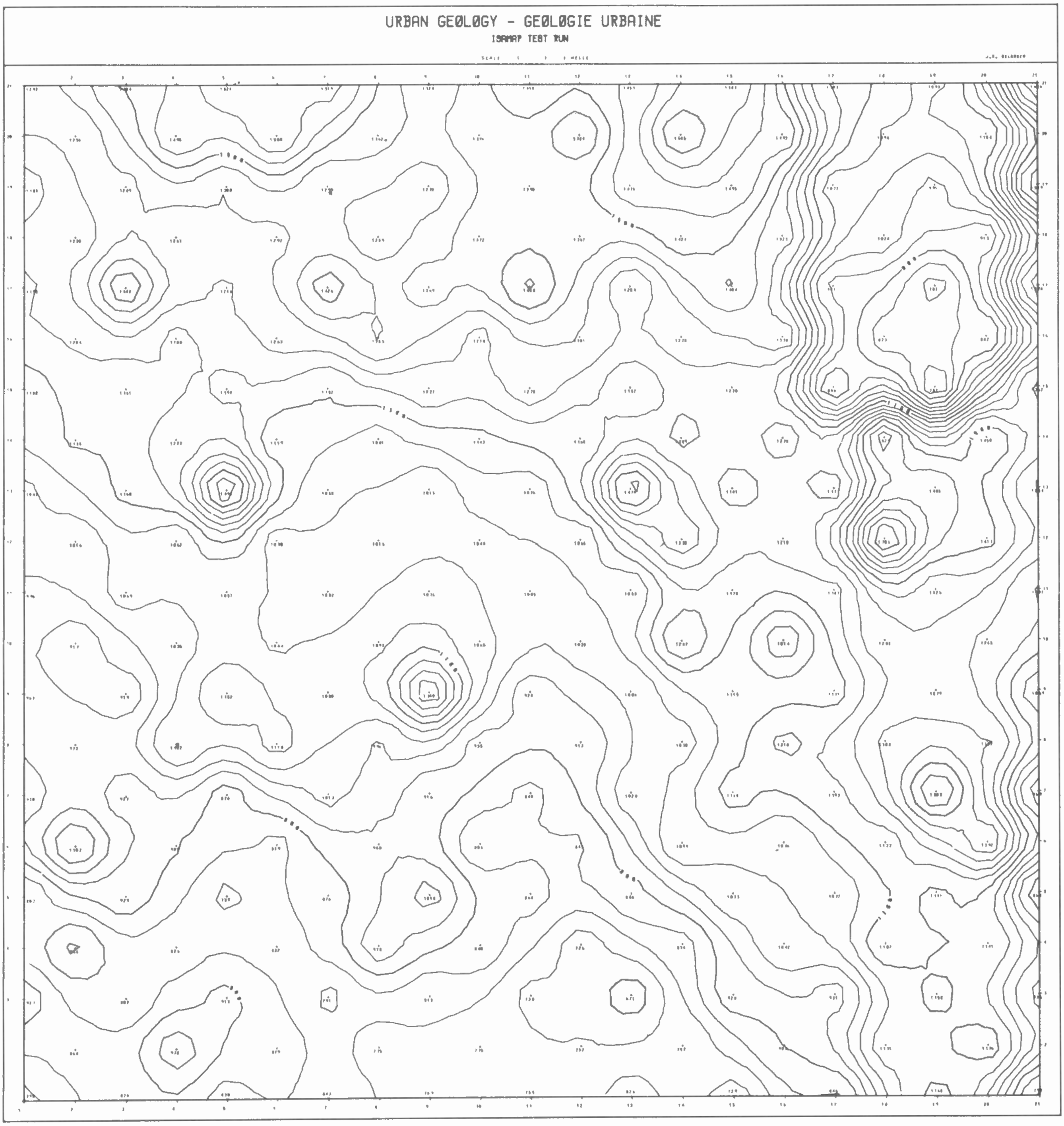
# APPENDIX A

## EXAMPLE OF MAPS

```
D3324,CM110000,P2,T100,MT1.
ACCOUNT,12345 ,2. ISAMAP RUN-1
REQUEST,GSCPLOT,S.                                    J.R. BELANGER
ATTACH,CONTROL,ISAMAP,ID=JRB.
XQT.
EOF *
1-FORMAT  (11X,F2.0,2X,F2.0,8X,F5.0)
2-SEQUENCE           123
26 070872    1   1      689   790   300   9899   9599
26 070872    1   3      689   927   370   9762   9392
26 070872    1   5      689   807   450   9882   9432
26 070872    1   7      689   930   500   9759   9259
26 070872    1   9      689   963   430   9726   9296
26 070872    1  11      689   996   480   9693   9213
____________
____________
____________
EOF *
1-BORDERS   1.       21.        1.          21.
2-AREA    1.         21.        1.         21.
3-GRID      .3          .3
4-SEARCH
5-NUMBER
EOF *

EOF *
1-INTERVAL           REGULAR      100              100
2-LABEL              REGULAR
3-SCALE                    1.            INCHES
4-BASE MAP          BLANK
5-POST         3
6-BLANK
7-INSTRUCTIONS      2
PEN SIZE.   PEN-1 = 2, PEN-2 = 1, PEN-3 = 00.
INK = BLACK, RIBBON = BLACK.
8-LEGEND
1-TITLE   URBAN GEOLOGY - GEOLOGIE URBAINE
2-SUBTITLEISAMAP TEST RUN
4-SCALE   RATIO
5-BORDER            1
6-ID       J.R. BELANGER
EOF *
EOF *
```

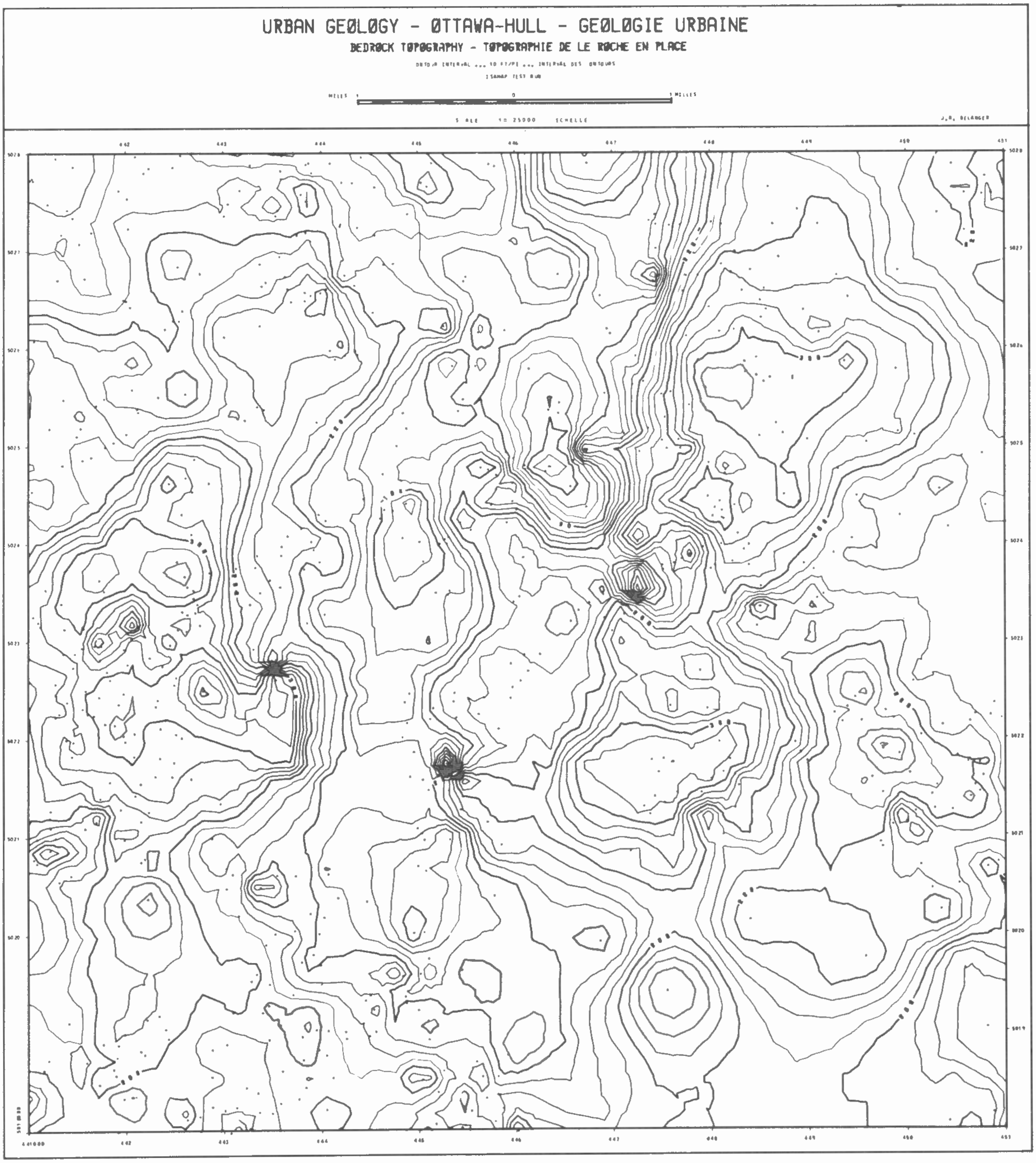
NOTE. EOF * MEANS END OF FILE.


URBAN GEØLØGY - GEØLØGIE URBAINE
ISAMAP TEST RUN

```
D3324,CM110000,P2,T100,MT1.
ACCOUNT,12345,2. ISAMAP TEST RUN
REQUEST,GSCPLOT,S.                                   J.R. BELANGER
ATTACH,TAPES,OTDAT,ID=JRB.
ATTACH,CONTROL,ISAMAP,ID=JRB.
XQT.
EOF *
1-FORMAT  UNFORMATTED
2-SEQUENCE          123
EOF *
1-BORDERS 441000.   451000.   5018000.  5028000.
2-AREA    440500.   451500.   5017500.  5028500.
3-GRID
4-SEARCH                               20.         1
5-NUMBER            5         9
EOF *

EOF *
1-INTERVAL           REGULAR      10              10
2-LABEL              REGULAR            4
3-SCALE                25000.          UTM
4-BASE MAP          BLANK
5-POST          1
6-BLANK
7-INSTRUCTIONS      2
RIBBON BLACK, INK BLACK
PEN SIZE= POS. 1= 2, POS.2= 0, POS.3= 00
8-LEGEND
1-TITLE   URBAN GEOLOGY - OTTAWA-HULL - GEOLOGIE URBAINE
2-SUBTITLEBEDROCK TOPOGRAPHY - TOPOGRAPHIE DE LE ROCHE EN PLACE
3-LEGEND  CONTOUR INTERVAL ... 10 FT/PI ... INTERVAL DES CONTOURS
3-LEGEND  ISAMAP TEST RUN
4-SCALE   BOTH
5-BORDER        1000
6-ID      J.R. BELANGER
EOF *
EOF *
```

NOTE. EOF * MEANS END OF FILE.


URBAN GEØLØGY - ØTTAWA-HULL - GEØLØGIE URBAINE
BEDRØCK TØPØGRAPHY - TØPØGRAPHIE DE LE RØCHE EN PLACE