COMPUTER TECHNIQUES FOR THE PRESENTATION OF PALYNOLOGICAL AND PALEOENVIRONMENTAL DATA

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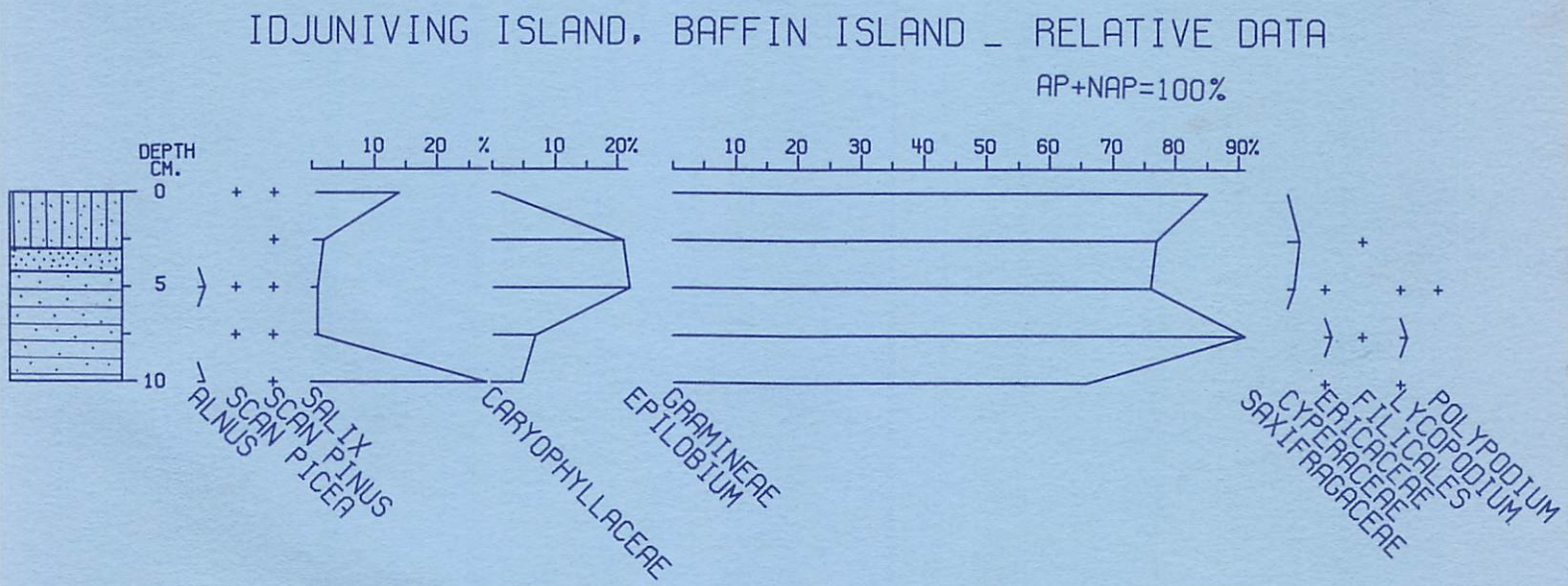

OCCASIONAL
PAPER No. 16 • 1979

INSTITUTE OF ARCTIC AND ALPINE RESEARCH
UNIVERSITY OF COLORADO

COMPUTER TECHNIQUES FOR THE PRESENTATION OF PALYNOLOGICAL AND PALEOENVIRONMENTAL DATA

by

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1979

Institute of Arctic and Alpine Research
University of Colorado
Occasional Paper 16

ISSN 0069-6145

Citation of this publication is Institute of Arctic and Alpine Research,
University of Colorado, Occasional Paper No. 16, 1979.

PREFACE

Institute of Arctic and Alpine Research (INSTAAR), University of Colorado, Occasional Paper No. 16 has been published four years out of sequence due to a number of unavoidable difficulties. It was originally intended as a sequel to No. 15, "Palynological and Paleoclimatic Study of the Late Quaternary Displacements of the Boreal Forest-tundra Ecotone in Keewatin and Mackenzie, N.W.T., Canada," by Professor Harvey Nichols, since the computerization of data processing and pollen diagram construction that is described in No. 16 was an outgrowth of palynological research that formed the basis of its predecessor. It is, nevertheless, still intended for use as a sequel. Technical problems initially delayed publication; yet as the basic research program progressed, the computer applications continued to evolve. In fact, improvements in the computer programs have been effected by the senior author as recently as December 1978. In addition, a variety of different data sets have exercised most aspects of the computer programs, sometimes uncovering errors or deficiencies in the original treatment. Thus an opportunity has arisen, if somewhat circumstantially, to correct the original programs, develop them further, and to make the end product produced here much more valuable to the potential user. It is also anticipated and hoped that further evolution will occur, both within INSTAAR and through the critical applications of this work by other groups.

This Occasional Paper, though highly specialized, is yet another product of INSTAAR's interdisciplinary research team concentrating upon applied and purely scientific aspects of environmental research in arctic and alpine regions. Since the linking theme of climatic change runs through the major part of INSTAAR endeavor, palynology and its derivatives are close to its core. It is also hoped that the present work will be applicable to all other environmental studies that apply palynology as a critical tool.

Margaret Eccles has been in association with INSTAAR as computer programmer since 1971. She has made valuable consultative contributions to many different areas of INSTAAR research and must be credited with the major burden of bringing this work to fruition. Margaret Hickey was a member of the INSTAAR research staff from 1970 to 1976, during which time she organized the daily routine of the Palynological Laboratory and provided invaluable input into the original developments of computerized pollen diagram construction and data processing. All of this, however, arose out of the early research of Harvey Nichols, senior INSTAAR palynologist, which resulted in reconstructions of the position of the arctic treeline in Keewatin and Mackenzie, N.W.T., Canada, over

the last 10,000 years and which formed the basis of Occasional Paper No. 15.

Jack D. Ives

Jack D. Ives
Director
INSTAAR

February 8, 1979

ACKNOWLEDGMENTS

This work was funded initially by NSF grant GB-33497 and latterly by NSF ATM77-17549. We thank Dr. S.K. Short for pollen analytical assistance, Dr. J.T. Andrews for reading draft copies of the text, Mrs. K.A. Salzberg for much skilled editorial assistance, and Mrs. L. Koch for typing.

CONTENTS

ILLUSTRATIONS

1.0 INTRODUCTION

The programs described in this report have been developed to assist in handling, storage, and manipulation of large volumes of paleoecological data and in semiautomatic production of pollen diagrams suitable for journal publication.

The only preexisting programs available to us when we began this project in 1973 were those of Dodson (1971) and Squires (1970). For our own use we developed an information storage and retrieval system that could be easily transferred to other computers; minor modifications for different compilers may be needed. The use of computer-drawn diagrams has grown since we began to devise our system in 1974, but we have continued since then to modify our programs for more varied use, and to revise them so that they might assist a wider audience. We believe that this system achieves a considerable degree of flexibility and applicability within the palynological field and potentially elsewhere in the paleoenvironmental sciences, for example, in studies concerning fossil seed analyses, beetle remains, grain-size analyses, and in stratigraphic paleontology.

1.1 "Absolute" Pollen Techniques

Much impetus for the development of our methods came from the progressive use of "absolute" pollen techniques in the Institute of Arctic and Alpine Research (INSTAAR) palynology laboratory. These techniques produce more "objective" data than the percentage (relative) methods used hitherto. In percentage pollen diagrams, the final count total is divided into each individual taxon sum and then plotted as a percentage, giving the percentage relationship of one taxon to another.

In determining these "absolute" values, we follow the dry weight (or "concentration") method as described by Jørgenson (1967), but the calculations are similar for the volumetric or "influx" method. The pollen on a slide is determined by

(i) counting the entire slide; or

(ii) recording the number of microscope traverses (t) necessary to obtain a certain grain total (n) such that the number of grains on the slide is $N = nT/t$, where T is the total number of traverses possible on that particular size coverslip on that particular microscope at that particular power of magnification. The total number of grains (N') in the treated sample may be determined by dividing the slide weight (a) into the sample weight (A), so that $N' = AN/a$. The total number of grains in the original sample per gram dry weight is therefore $N'' = (AN)/(aG)$, where G is the pretreatment dry weight of the sample.

Calculation of these "absolute" values according to the above method is tedious, but the simple repetitive nature of obtaining the "absolute" value for each taxon lends itself very well to computerization.

1.2 Tracer Materials

The foregoing calculation is limited in accuracy by the necessary assumption that there is no loss of pollen during preparation of the material. By adding a known amount (E) of exotic tracer such as *Lycopodium clavatum* spores or *Eucalyptus* pollen grains embedded in a matrix of calcium, it is possible to calculate the percentage loss during chemical reduction (Stockmarr, 1971). Therefore, the true "absolute" number of grains per gram is $\underline{N} = N''E/e$, where e is the number of exotic tracer grains recovered in the prepared sample.

It is also useful to determine this recovery factor as a percentage, because the efficiency of the sample recovery has significant bearing on the validity of the data and may involve later repreparation of the sample. Preparation losses do vary substantially depending on the type of sediment being treated; data are being collected so that previously determined "absolute" values on different types of sediment

may be compared.

1.3 Scan Counts

A need for modified presentations of standard pollen diagram presentation arose from our study of "trace" amounts of exotic tree pollen in arctic tundra sediments. Changes in exotic pollen influx, due to transport of boreal forest pine and spruce pollen hundreds of kilometers into the tundra, cannot be observed fully from a normal count total since the percentage occurrence of these pollen types is so low compared to that of the local vegetation. We therefore scan count entire slides just for the exotic pine and spruce, at a lower magnification than normal (200x). More than one slide is counted if higher totals are desired. For easier data presentation, a punched card output of these scan values is also produced by the POLDATA program.

1.4 General Remarks

Flow diagrams have been included for GROFORM and LEGEND. They were not included for POLDATA, PRPLOT, DISPLAY, and DGTIZR only because of their size, and they may be obtained from the Publications Data Depository, Institute of Arctic and Alpine Research. In addition, Appendix I provides a glossary of variable names used in each program. It is hoped that this will aid the user in understanding any particular part of the program code.

The programs which produce output on the CALCOMP plotter (DISPLAY and LEGEND) use plot routines which are specific to the local computer installation. A list of the particular routines used, along with a description of the arguments, is provided in Appendix II to facilitate conversion to routines available at the user's installation.

Appendix III contains summaries of the card input for each program. These summaries are also found in the complete program listings located at or near the end of each section.

The flow chart (Figure 1.1) demonstrates the procedural order in which the programs are used.

1.5 Summary of Steps to Produce a Typical Pollen Diagram

1) Code original data counts or the digitization of diagrams.

2) Keypunch and list the cards to check for mispunches.

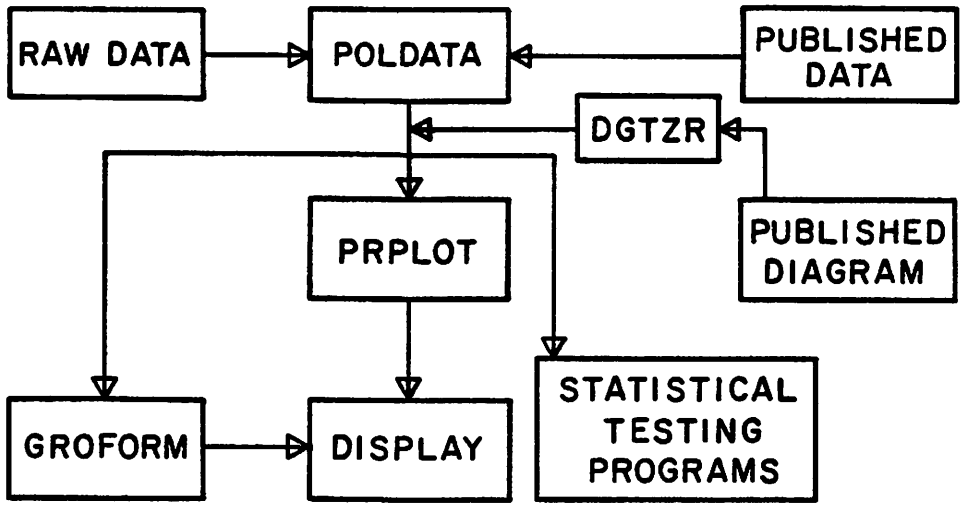


Figure 1.1. Procedural order for programs.

3) Make preliminary runs of POLDATA until the output has been completely checked against the counting sheets.
4) Produce final POLDATA listing, reordering if necessary. Also produce the card output decks, interpreting and sorting card decks according to type: relative R, "absolute" A, and scan values S.
5) Produce a line printer diagram using card output decks (R and A) as input to PRPLOT.
6) Use the "absolute" compressed deck as input to the GROFORM program to obtain numerical values and card decks Ecology E and Life Form L, used in Ecology and Life Form diagrams, interpreting and sorting card output.
7) Use DISPLAY program to produce CALCOMP plots of Relative, Absolute, Ecology, and Life Form diagrams.
8) Use card output deck A as input to statistical routine, for the selection of radiocarbon dating horizons.

9) Draw labels and legend of the diagram, as well as radiocarbon assays, on the CALCOMP plotter and add them to the diagram prior to photography.

1.6 POLDATA

The program POLDATA is the first stage necessary for examination of the data. POLDATA produces a computer printout listing the count totals and other information concerning that particular analysis. The calculated values of the relative percentages and the "absolute" values, as determined from the equations in Sections 1.1 and 1.2, are then printed. For further manipulation of the data, a separate punched card output of these values is generated.

1.7 PRPLOT, DISPLAY

For inspection of the profile, a preliminary diagrammatic presentation of the relative percentage pollen diagram and the "absolute" value pollen diagram can be produced economically and quickly by means of the program PRPLOT. This is achieved by having fixed scale parameters and using a line printer giving a histogram representation of the relative and "absolute" values. The input values from which the diagram is plotted are obtained from the punched card outputs from the POLDATA program. When the data are complete, the line printer diagram is used to calculate the scales and truncation points to be used in drawing a diagram of the required size for publication on the CALCOMP plotter using the program called DISPLAY.

1.8 Statistical Programs

In our paleoenvironmental investigations, the statistical significance of relatively small-scale vegetational changes in plants adapted to variable arctic summers can more easily be judged by the machine approach than by visual inspection. Use of the computer to handle large numbers of variables will produce more "objective" decisions about division of the pollen diagram into zones (cf. Gordon and Birks, 1974). The card outputs of the "absolute" values are used as input to a principal components analysis. Factor scores are examined to reduce the number of significant taxa being considered. A clustering routine is then based on these factor scores and a dendrograph drawn from this

output. The pollen zonations are then determined from the replot of the clusters in stratigraphic order, and these major environmental divisions in the diagram may then be sampled for radiocarbon dating.

1.9 GROFORM

Collaboration with Dr. P.J. Webber of INSTAAR has led to division of the pollen taxa into "growth form" assemblages, along with simple substrate inferences (hydric, mesic, xeric; wet, intermediate, dry). Thus, it was also necessary for various palynomorph assemblages to be presented from the same data set. From the initial POLDATA "absolute" punched card output, an Ecology diagram is produced based on reclassification of the taxa into xeric, mesic, and hydric (plus exotic pollen); a Growth Form diagram is also produced providing tree, shrub, herb, graminoid, moss, and fern divisions. These categories are calculated as "absolute" numbers and as percentages of the total pollen numbers by the program GROFORM. Since the diversity of taxa and their relative productivity are also measures of climatic status, the Simpson's diversity ratio and the Shannon's diversity ratio (Ager, 1963) are also calculated (see Section 4.1). Output from GROFORM is then used as input to the DISPLAY program.

1.10 Other Data, Tabulated

The programs have been written so that the data of other workers could be treated in the same manner. Where original data counts are available, the POLDATA program may be used to process them. Options have been included in the program to calculate the "absolute" number of grains per sample for any given unit of measurement. If a volumetric determination is made, the total number is divided by the volume of the original sample. Similarly, the number of grains per unit area of sample is obtained by dividing the calculated value by the cross-sectional area.

1.11 Published Diagrams (DGTIZR)

Published diagrams present a greater problem, since generally these are primarily percentage diagrams; however, values can be recalculated from the diagrams and processed by the POLDATA program. A faster and more reliable method is to use a digitizer to obtain numerical values from the published diagrams. The program DGTIZR was designed to transform

digitizer output to a form comparable to the output from POLDATA.

1.12 Reordering of Taxa

Another feature of the POLDATA program permits the reordering of taxa. Final output (both cards and printout) may be in alphabetic order, or taxonomic groupings, even omitting any number of taxa entirely, regardless of the order of the input. This facilitates the interlaboratory exchange and interrogation of data and could form the basis of a national or international archival system. Such a system would also aid secondary analysis of the data by any interested party and simplify correlation of environmental studies of different regions.

2.0 POLDATA

The POLDATA program was developed with several goals in mind: (1) to reduce storage problems by storing palynological data on punched cards rather than large volumes of pollen counting sheets, (2) to reduce risk of data loss by easy reproduction of the data, (3) to provide a checking procedure for verifying data counting sheets, (4) to produce accurate calculations of relative percentages and "absolute" values, and (5) to provide these results in punched card form for further processing. Format of both data input and printed output were largely determined by the format of counting sheets already in use (note similarity of Figures 2.1 and 2.2). The variety of sample types analyzed, as well as the different procedures involved, required that the program be fairly flexible. This chapter describes the various sample types and procedures, explains how the program meets these needs, gives a description of the card set-up required by the POLDATA program, and describes the output.

2.1 Data Types

Information for this program is currently drawn from subfossil sediments and from modern pollen trap materials. These fossil pollen sources are measured in oven-dry weight or by volume of sediment deposited in unit time; the modern pollen numbers (derived from polsters or samplers) provide a total palynomorph count per trap and preferably per unit area.

2.2 Site and Sample Identification

A simple identification scheme was set up when the POLDATA program was first developed, so that each data set consists of a number of micro-

scope slides or samples obtained from a certain site. Five characters are allowed for the site identification, and four characters for the slide identification. The five-character site code is punched in the first five columns of every data card associated with that site as a protection against scrambling of the cards. The microscope slide identification is punched in the next four columns (6-9). For samples from a sediment column, the depth of the sample, coded in millimeters, is adequate identification. Collections of modern pollen deposited in traps are currently represented by three common types of static collectors: the Tauber trap (Tauber, 1974); the Tuffy trap as described by Benninghoff (1965); and the volumetric powered sampler designed by Hirst (1952). The modern pollen data are coded in four columns: a Tauber trap is designated by TT followed by an identification number for the trap; Tuffy traps are designated TFY, with space for a one-digit identifier for use where there is more than one trap at each site; and Hirst sampler data is designated HRST.

As other types of samples were analyzed, the four-column code was not always adequate to identify a sample in a meaningful way without a dictionary of codes. Therefore, for single moss polsters, individual soil samples, or archaeological material (the "all others" of the third general category mentioned above) the convention adopted uses all nine characters to identify the particular sample so that suitable terms can be used. Although reassembling a scrambled deck is now more tedious, the more complete identification was judged to be vital.

2.3 Data Organization

The taxa on the counting sheets used by this laboratory are divided into three groupings: trees and shrubs, herbs, and spores. Within each of these groups the taxa are listed alphabetically. For ease of coding and keypunching, this sequence was maintained. In the course of counting slides for an entire site, unexpected taxa are sometimes encountered; therefore space must be provided for adding on taxa in each grouping. Each group is therefore kept on a separate card.

This laboratory typically records total counts of 300 palynomorphs, including arboreal and nonarboreal taxa; this total excludes any taxa

which may be over-represented due to the nature of the sediment matrix (normally Cyperaceae, Ericaceae, and Sphagnum) and excludes the exotic tracer palynomorphs (Lycopodium and Eucalyptus). For most taxa, three columns are adequate to specify the total count for that taxa. However, taxa that are excluded from the 300 total may have substantially higher counts; four columns were therefore allowed for each count, allowing totals up to 9999.

In addition to the count total of 300 palynomorphs, two intermediate subtotals may be included (e.g., at 100 and 200 palynomorphs) to give an indication of the consistency and random distribution of pollen on a slide. These subtotals are also useful for determining the quality of the count data.

2.3.1 *Card Format*

The organization of a count card may be summarized as follows:

Data Field (Card Columns)	Contents of Field
1-5	Site identification
6-9	Slide identification
10	Taxon group (T, H, or S for trees and shrubs, herbs, or spores)
11-13	Count total recorded for all taxa excepting those excluded from main count (e.g., Cyperaceae, Ericaceae, Sphagnum, plus exotic additives) (typically 100, 200, or 300)
14	Card number (always 1 except for herb group)
15-18	Count for first taxon in group
19-22	Count for second taxon in group
etc., for up to 16 taxa in group	

See Figure 2.3 for a typical listing of data cards.

2.4 Name Cards and Format

Name cards identify the taxa in each group. Three-column codes identify each taxon (see list of codes used by this laboratory, Appendix IV), leaving a blank space in front of each code for legibility. The card layout is thus the same as for count cards, except that count totals

are not applicable. In summary:

Data Field (Card Columns)	Contents of Field
1-5	Site identification
6-9	Slide identification
10	Taxon grouping (T, H, or S for trees and shrubs, herbs, or spores)
11-13	Blank
14	Card number (always 1 except for herb group)
15	Blank
16-18	Code for first taxon in group
19	Blank
20-22	Code for second taxon in group
etc., for up to 16 taxa in group	

Certain conventions concerning taxon codes were written into the POLDATA program. If an exotic tracer palynomorph is used, it must be identified by a code beginning with XX (i.e., XXL for Lycopodium clavatum when used as an exotic tracer, as opposed to LCL when located as a subfossil spore). A search is also made for codes PIC and PIN (Picea and Pinus) in order to identify these taxa for scan counts.

2.5 Scan Picea and Scan Pinus

Changes in exotic pollen influx due to transport of boreal forest tree and shrub pollen are of special interest in the Arctic tundra (Nichols et al., 1978). The low percentage occurrence of these pollen types compared to the local pollen production makes accurate observation of this phenomenon difficult. Consequently, these two taxa are usually counted from the entire slide in addition to the regular count. These counts are referred to as Scan PICea and Scan PINus, or S-PIC and S-PIN. They are recorded separately from the regular counts (see Section 2.6.6).

Sometimes an interesting taxon is observed on a slide outside of the area counted. This observation is recorded with a special code (-1); it is not registered as part of the count total but is noted as SCAN on the printed output.

A few slides may be counted only for Picea and Pinus, designated as "scan" counts. The presence of various additional taxa is noted with -1, and the count total is recorded as -1. No percentages are calculated in this case, but the "absolute" count based on the S-PIC and S-PIN counts is calculated and printed (see Figures 2.4 and 2.5).

2.6 Card Input for POLDATA

The diversity of the sample types handled by POLDATA requires other information to be specified for each computer run. Each card or set of cards will be described in detail in the following section, and a summary of the cards and their format is found in Appendix III.

2.6.1 *Option Cards*

These are cards which allow certain program options. They may or may not be present in any particular computer run; the program can function with or without them. They fulfill two different functions. One of these functions enables the program to produce compressed card decks of the values calculated by the program. If a card beginning with the word PUNCH is present, punched output is produced; if no such card is present, no punched output is produced.

The other function specifies the sample type or material source, as described in Section 2.2: these are subfossil sediments, modern pollen traps, and miscellaneous data. A card beginning with the word DEPTH selects the fossil sediment profiles, and a card beginning with the word TRAP selects the trap data. Only one of the two may be used for any card input setup. If neither DEPTH nor TRAP is present, the program selects the third sample type (miscellaneous data).

There may be two option cards (PUNCH and either DEPTH or TRAP), or there may be one or none. No particular sequence is expected when two option cards are present. The program only requires that all option cards come before any other cards and that each option card begin in column 1.

2.6.2 *Title Card*

This card is required for all runs, following immediately after the option cards, if any. If no option cards are used, it is the first card. It fills several functions.

The first 60 columns are available to specify the site name and any other identifying information desired. This title appears at the top of every page of the printed output; when the PUNCH option is selected this information will appear on the first card of the punched deck.

When certain taxa are to be excluded from the count totals, they are specified on the title card. Exclusions are identified by putting the appropriate three-character codes (with leading blank, for a total of four characters) beginning in column 61. Up to five exclusions may be selected and all must appear in "S" group of taxa names. For this reason, the exotic tracer is always included in the "S" group. The entire "S" group can be excluded by simply punching an "S" in column 62, allowing up to 16 taxa to be excluded. If a taxon name is not found in the "S" group, it is ignored (and therefore not excluded).

The program checks for the word SAME in the place of the first exclusion. If this is found, the program assumes that certain information is the same as that specified for a previous site. A fuller explanation of this option will be given later in Section 2.6.8.

The following summarizes the contents of the title card:

Data Field (Card Columns)	Contents of Field
1-60	Site description; appears at top of each page of printed output
61-64	Code for first taxon to be excluded (61 must be blank) or _S__ to exclude all taxa in the "S" group or SAME to repeat information from a previous site
65	Always blank
66-68	Code for second taxon to be excluded (if any)
69	Always blank
70-72	Code for third taxon to be excluded (if any)

etc., for up to 5 exclusions

2.6.3 *Unit Card*

In order to label the printed output properly, the program requires information about the units of measurement. The unit card provides these labels. The first six columns identify the unit (CC, GM, SQ. CM), and columns 11-14 identify the type of unit (VOL, WT, AREA). If no absolute value is to be calculated, as for digitized diagrams, the unit card should be left blank.

2.6.4 *Name Cards*

The format for name cards was discussed in the section above dealing with taxa names and codes. It should, however, be noted that name cards must appear in the order T, H, S (trees and shrubs, herbs, and spores), with only the H group permitted to extend to a second card. Any deviations from this are detected by the program which will then stop.

A "name" punched as "- " (minus sign followed by two blanks) will cause the program to ignore any data in the corresponding field on the count cards. This enables a data set to be reanalyzed with the exclusion of certain taxa without repunching the cards.

2.6.5 *Reorder Cards*

It is sometimes desirable to arrange the taxa names in a different sequence from that of the original counting sheets. This may happen when taxa are added to the list as they are discovered during the counting; alphabetical order is generally not preserved if this is the case. It is also useful for ease of comparing sets of samples from different laboratories using different conventions for taxa sequences, so that the data need not be repunched in order to present the results in a different format.

The program requires at least one card, whether or not reordering is to be done. This is a card specifying the number of taxa to be reordered, i.e., the number of taxa in the reordered list, punched in columns 2-3.

If no reordering is to be done, a single blank card is all that is needed. Otherwise, one or more cards must follow, specifying the new sequence as a series of numbers separated by commas. As an example, assume an original set of six taxa in the order ALN, FRA, SLA, PIC,

PIN, BET. To change these into alphabetical order, the following cards must be supplied:

__6

1, 6, 2, 4, 5, 3

The reorder option permits the examination of a subset of the entire list of taxa. For example, to obtain a tabulation of Picea and Pinus only in the above example, the following cards should be used:

__2

4, 5

Figure 2.2 illustrates a typical situation where taxa were added to the list; Figure 2.6 shows the reordered output and Figure 2.7 compares the card setups used to produce the two versions.

It is assumed that all data checking will be done in the original format and that when reordering is desired the data are ready to be punched. Therefore, the program will not change the order of the output unless the PUNCH option is selected. The reorder cards will be read and the new order listed (thus permitting checking of the new sequence) but the sequence on the printed output will remain the same if no PUNCH card appears among the option cards.

2.6.6 *Slide Header Card*

The cards described in the five sections above all appear only once for each site, while the following cards are repeated for each slide from the site. A card must be included for each slide giving general information for that slide, including the slide identification, number of traverses counted, sampling measurement, weight of slide, scan counts (if any), exotic tracer added (if any), and (for moss and lichen polsters only) the polster species. Each of these will be described in some detail here; for a brief summary see Appendix III.

Data Field (Card Columns)	Contents of Field
1-5	Site identification
6-9	Sample identification (depth in millimeters, trap designation, or other identification using all of columns 1-9).

Data Field (Card Columns)	Contents of Field
10-14	Weight of prepared slide in grams (2). This must be a number less than 1, with a decimal point punched in column 10. If there is no slide weight, as is the case for data taken from a published diagram, the slide weight will be zero, but the decimal point must appear in column 10. No slide weight and a blank unit (see Section 2.6.3) will suppress the calculation of "absolute" values.
15-19	Weight of treated sample in grams (A).
20-24	Initial weight, volume, or area sampled (G). The appropriate label for this measurement is selected by the unit card.
25-29	Number of traverses (t) required to obtain the highest count total. If this field is blank the program assumes that the entire slide was counted and prints ALL in the output.
30-31	Alphabetic code designating microscope used (so that area of field of view is registered).
32-33	Length of the coverslip (in millimeters) of the slide
34-35	Magnification used in the count
36-40	Total number of traverses possible (T) for specified microscope at specified magnification for a coverslip of specified length. (Note: this could have been calculated by the program, but the range of possible values used at this laboratory was small enough that a table was used and the value entered on the keypunching sheets.)
41-44	Count value for Picea (S-PIC) obtained over the whole slide (if such count was made).
45-49	Count value for Pinus (S-PIN) obtained over the whole slide (if such count was made).

Data Field (Card Columns)	Contents of Field
50	Always blank
51-55	Number of exotic tracer additives (Section 1.2) added to the sample (if any).
56-65	Always blank
66-80	Name of polster type (where applicable)

2.6.7 *Count Cards*

For the format of the count cards see Section 2.3. A complete set of count cards for a slide consists of three (or four, if there are more than 16 taxa in the "H" group) cards for each count total or subtotal. A count card with no count information may be omitted, and if a count card is inadvertently omitted all values on it are assumed to be zero. The cards need not be in the T, H, S sequence, and different count totals and subtotals may be interspersed. An orderly sequence is recommended for ease in checking data, but the program will function smoothly even if this is not the case.

2.6.8 *Summary of Card Sequences*

Sets of cards consisting of a slide header card and count cards are repeated for each slide from a given site. More than one site may be processed in the same card deck by repeating the entire sequence from the beginning, with an end-of-record indicator separating the two sequences.

If many sites with only a few slides each are being processed (e.g., a series of traps from the same general area, but different locations within the area), it would be convenient not to specify the options, units, names, and reordering sequence when these are the same for all the locations. The program allows for this in two ways. First, the option card(s) are assumed to be repeated if the sequence begins with the title card without an end-of-record indicator between the two. Second, the exclusions, unit of measurement, taxon names, and reordered sequence of taxa are all assumed to be the same as for the previous site if the word SAME appears in columns 61-64 of the title card. These two "short

cuts" may be used together or independently.

If the various parts of the input are labeled as follows:

A. option card(s)

B. title card

B*. title card with SAME

C. unit card

D. name cards

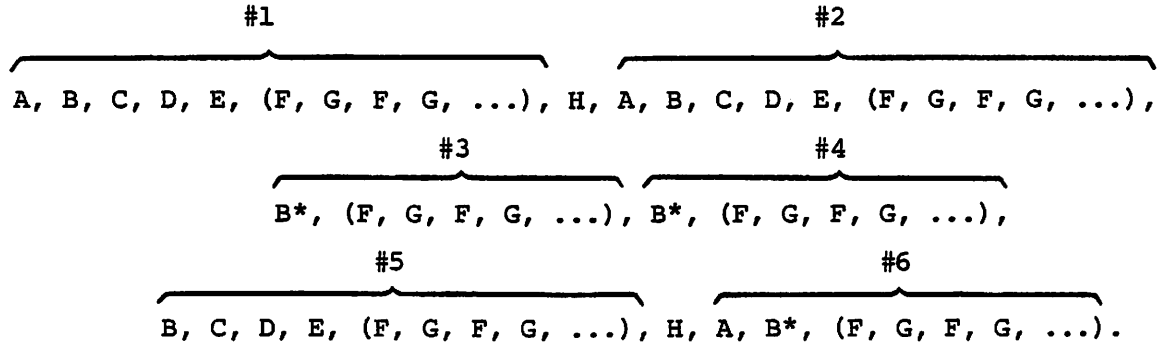
E. reorder card(s)

F. slide header card

G. count cards

H. end-of-record indicator

then the following sequence will illustrate several possibilities:



Set #1 and Set #2 are totally independent. Sets #3 and 4 both use the same options, exclusions, and taxon sequence as set #2. Set #5 uses the same options, but a different taxon list, while set #6 uses the same unit of measurement, exclusions, taxon names and sequence but different options (as would be the case for traps and polsters at the same site).

2.7 Printed Output

For each site, any options selected are printed and the new card order, if any, is listed. This provides a means of checking the card setup for gross errors. Each site is thus separated by the new card order printout and may be easily located by leafing quickly through the printed output.

2.7.1 *Slide Header*

Each microscope slide count is printed on a separate page. The title appears at the top of the page, along with any exclusions and the polster type, if any. The next two lines list the information from

the slide header card, with appropriate labeling provided by the unit card.

If an exotic tracer has been added, a further check on consistency of distribution over the slide is made. The calculated "absolute" value for the tracer over the entire slide is divided by the number of tracer grains added and multiplied by 100 to obtain the percentage recovery. This value is printed below the slide information.

2.7.2 *Count Data*

The rest of the page is taken up by a listing of the counts and calculations for each taxon, with the T, H, and S groups separated by a blank line. The three-letter taxon code appears on the far left. To the right, under the heading COUNT, there are up to three columns (depending on the number of subtotals), each column being headed by the appropriate total or subtotal. To the right of these is a section labeled PERCENT, with each count or subcount converted to a percentage of the total.

If the count data were obtained from published diagrams or other sources besides a direct count from slides, the rest of the page will be blank (see Figure 2.8).

In the middle of the page the "absolute" calculations are listed under the heading ABS/unit with the appropriate term supplied from the unit card. Only the highest total is listed. For trap data, the unit designated is TRAP, with a second set of three columns specifying ABS/unit if the original sample measurement on the slide header card (G, columns 20-24) is nonzero (see Figure 2.9).

2.7.3 *Scan*

If a scan count for Picea and Pinus was obtained, the "absolute" count is calculated and printed next to the regular count value under the heading SCAN. A comparison of these two values gives another quality check of the slide and the distribution of pollen on it.

2.7.4 *Count Total Discrepancies*

If the total of nonexcluded taxa for any count total or subtotal was not equal to the count total supplied on the card, this error will be flagged and the percentages recalculated based on the calculated

total. The revised percentages will appear on the far right of the page (see Figure 2.10). This feature is particularly useful when a data set is to be analyzed both with and without exclusions. The count total and subtotal need not be repunched, as the "corrected" percentages are based on the actual total rather than the total or subtotal designation (see Figure 2.10 for an example of a polster count analyzed both ways; Figure 2.11 compares the card setups for Figure 2.10a and 2.10b).

2.7.5 *Distribution Check on Count Data*

The percentages calculated for subtotals and total give a further indication of data quality. If the percentages vary substantially between the different subtotals, a larger area of the slide, or perhaps an additional slide, should be counted. The problem may also be a difficulty in positive identification of the grains; in this case the sample should be reprepared. Figure 2.12 is an example of excellent distribution of grains, whereas Figure 2.13 shows a poor distribution. Since the number of traverses counted was so small, a lower density slide was counted.

2.8 Card Output

When the PUNCH option is selected, the POLDATA program produces a deck of punched cards. The first card is the title (columns 1-60 from the title card). The number of the last taxon in each of the three groups (T, H, and S) is punched on a second card in three three-column fields.

For each slide, one or more sets of cards is punched. All have the same 14-column identification as the original input data, except that column 10 contains a flag for the data type instead of T, H, or S.

The scan deck (coded S in column 10) is punched for all slides with values for S-PIC and S-PIN. The values are punched in eight-column fields beginning in columns 15 (see card format below). One card only is required for each slide.

The "absolute" deck (coded A in column 10) is punched for all slides but excludes those only scan-counted and data from previously published sources which are not "absolutely" based. The format is the same as for the scan deck. Up to twelve cards may be required for all

the values.

The relative deck (coded R in column 10) is punched for all slides which are not scan-counted only. The values are punched in four-column fields beginning in column 15 (see card format below). Up to six cards may be required for all the values.

The various decks are punched for each slide, so that S, A, and R decks are interspersed; they are easily separated by sorting according to the code in column 10. (See Figure 2.14 for a set of cards both unsorted and sorted.)

2.9 Format of Output Cards

Relative

Data Field (Card Columns)	Contents of Field
1-5	Site identification
6-9	Slide identification
10	Data type (R)
11-13	Highest count total
14	Card number
15-18	Percent value of first taxon
19-22	Percent value of second taxon
...	etc. for up to 16 taxa

For more than 16 taxa, additional cards are used.

Absolute or Scan

Data Field (Card Columns)	Contents of Field
1-5	Site identification
6-9	Slide identification
10	Data type (A or S)
11-13	Highest count total
14	Card number
15-22	Absolute value of first taxon
23-30	Absolute value of second taxon
...	etc. for up to 8 taxa
79-80	Moss polster type (if applicable)

For more than eight taxa, additional cards are used.

Figure 2.1. A typical counting sheet.

Prep. Date 3-78 Count Date 4/24/78 Analyst S

Site TASIGULUK L.

Depth 90 cm Slide Wt. .0714 gm Treated Sample Wt. .3121 gm Sample Wt. .7394 gm

Abs.	Rel%		T 100	T 200	T 300
		ABIES			
		ALNUS	18	30	
		BETULA	34	67	
		PICEA	11	24	
		PINUS	3	6	
		SALIX	7	16	
		AMBROSIA	1	2	
		ARTEMISIA ✓		+	
		CARYOPHYLLACEAE	1	1	
		CHENOPOD			
		COMPOSITAE tub	1	2	
		EPILOBIUM		1	
		GRAMINEAE	16	34	
		MYRICA		2	
		POTENTILLA			
		ROSACEAE			
		RUBUS			
		Oxyria ✓		+	
		CYPERACEAE	31	59	
		ERICACEAE	1	2	
		Polypodium FILICALES		1 2	
		LYCOPODIUM clavatum	8	12	
		SPHAGNUM	5	7	
		EXOTIC	259	520	

TRAVERSES

Ac	C
24	40
12	32
20	36
16	28
8	38
22	10

top 90.3

bottom 112.2

stop 109.8

direction B → T

$G_{200} = 11.1096$

microscope LS

slide 40

power 40

gamma 87.9

TASIGULUK LAKE, LABRADOR-UNGAVA 1975 EXCLUDED FROM COUNT: CYP ERI SPH

DEPTH = 90.0 CM SLIDE WT = .0714 GRAMS TREATED SAMPLE WT = .3121 GRAMS SAMPLE WT = .7394 GM

11.11 TRAVERSES MICROSCOPE LS SLIDE 40 POWER 40 NO. OF TRAV. POSSIBLE = 87.9

	COUNT		PERCENT		ABS/GM
	100	200	100	200	200
ABI					
ALN	18	30	18	15	1403
BET	34	67	34	33	3134
PIC	11	24	11	12	1123
PIN	3	6	3	3	281
SAL	7	16	7	8	748
AMB	1	2	1	1	94
ART		SCAN		SCAN	SCAN
CAR	1	1	1	.5	47
CHE					
COM	1	2	1	1	94
EPI		1		.5	47
GRA	16	34	16	17	1590
MYR		2		1	94
POT					
ROS					
RUB					
OXY		SCAN		SCAN	SCAN
CYP	31	59	31	29	2760
ERI	1	2	1	1	94
POL		1		.5	47
FIL		2		1	94
LYC	8	12	8	6	561
SPH	5	7	5	3	327

Figure 2.2. Printed output from POLDATA for the same sample.

```
CARD COLUMN:
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

TRACK110 T1001      37  20          28   4
TRACK110 T2001      71  49          50   6
TRACK110 T3001     105  73          76   7         1
TRACK110 H1001                  1                 1    2
TRACK110 H2001                  4                 3    3
TRACK110 H3001       1          7             1    4    4    1
TRACK110 S1001   2       4   3
TRACK110 S2001   3       9   5
TRACK110 S3001   5   1  13   7

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

Figure 2.3. A listing of the count cards for a sample from Track Lake.

```
CARD COLUMN:
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

OWLR 277 T -11              -1  -1
OWLR 277 H -11      -1  -1  -1                  -1          -1
OWLR 277 S -11      -1  -1  -1      -1

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

Figure 2.4. A listing of the count cards for a sample which was scan-counted only.

```
OWL RIVER, BAFFIN ISLAND                                    EXCLUDED FROM COUNT: CYP ERI SPH XXL

DEPTH = 277.0 CM  SLIDE WT =  .0308 GRAMS  TREATED SAMPLE WT =  .2328 GRAMS  SAMPLE WT  =  .7256 GM

   ALL TRAVERSES  MICROSCOPE LD  SLIDE 40  POWER 16  NO. OF TRAV. POSSIBLE =   34.6          SPIC =    2  SPIN =    3
```

	COUNT	PERCENT	ABS/GM	SCAN
ALN				
BET				
PIC				21
PIN	SCAN	SCAN	SCAN	31
SAL	SCAN	SCAN	SCAN	
JUG				
ACE				
ULM				
AMB				
ART	SCAN	SCAN	SCAN	
CAR	SCAN	SCAN	SCAN	
CHE	SCAN	SCAN	SCAN	
CIR				
COM				
CRU				
EPI				
GRA	SCAN	SCAN	SCAN	
MYR				
ROS				
RUB	SCAN	SCAN	SCAN	
SAX				
UMB				
BOT				
CYP	SCAN	SCAN	SCAN	
ERI	SCAN	SCAN	SCAN	
FIL	SCAN	SCAN	SCAN	
XXL				
LYS	SCAN	SCAN	SCAN	
OPH				
SPH				

```
TRAP  OPTION SELECTED
```

Figure 2.5. POLDATA output for the preceding.

TASIGULUK LAKE, LABRADOR-UNGAVA 1975 EXCLUDED FROM COUNT: CYP ERI SPH

DEPTH = 90.0 CM SLIDE WT = .0714 GRAMS TREATED SAMPLE WT = .3121 GRAMS SAMPLE WT = .7394 GM

11.11 TRAVERSES MICROSCOPE LS SLIDE 40 POWER 40 NO. OF TRAV. POSSIBLE = 87.9

	COUNT		PERCENT		ABS/GM
	100	200	100	200	200
ABI					
ALN	18	30	18	15	1403
BET	34	67	34	33	3134
PIC	11	24	11	12	1123
PIN	3	6	3	3	281
SAL	7	16	7	8	748
AMB	1	2	1	1	94
ART		SCAN		SCAN	SCAN
CAR	1	1	1	.5	47
CHE					
COM	1	2	1	1	94
EPI		1		.5	47
GRA	16	34	16	17	1590
MYR		2		1	94
POT					
ROS					
RUB					
OXY		SCAN		SCAN	SCAN
CYP	31	59	31	29	2760
ERI	1	2	1	1	94
POL		1		.5	47
FIL		2		1	94
LYC	8	12	8	6	561
SPH	5	7	5	3	327

Figure 2.6. POLDATA output for the same sample as in Figure 2.2, reorganized.

```
CARD COLUMN:
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890


DEPTH
TASIGULUK LAKE, LABRADOR-UNGAVA  1975                          CYP ERI SPH
GM         WT
TASIG     T    1 ABI ALN BET PIC PIN SAL
TASIG     H    1 AMB ART CAR CHE COM EPI GRA MYR POT ROS RUB OXY
TASIG     S    1 CYP ERI POL FIL LYC SPH

TASIG 90 .0714.3121.739411.11LS404087.9
TASIG 90 T1001       18  34  11   3   7
TASIG 90 T2001       30  67  24   6  16
TASIG 90 H1001   1       1       1      16
TASIG 90 H2001   2  -1   1       2   1  34   2              -1
TASIG 90 S1001  31   1               8   5
TASIG 90 S2001  59   2   1   2  12   7


         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

a. Setup for Figure 2.2.

```
CARD COLUMN:
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890


DEPTH
TASIGULUK LAKE, LABRADOR-UNGAVA  1975                          CYP ERI SPH
GM         WT
TASIG     T    1 ABI ALN BET PIC PIN SAL
TASIG     H    1 AMB ART CAR CHE COM EPI GRA MYR POT ROS RUB OXY
TASIG     S    1 CYP ERI POL FIL LYC SPH
 24
1,2,3,4,5,6,7,8,9,10,11,12,13,14,18,15,16,17,18,20,22,23,21,24
TASIG 90 .0714.3121.739411.11LS404087.9
TASIG 90 T1001       18  34  11   3   7
TASIG 90 T2001       30  67  24   6  16
TASIG 90 H1001   1       1       1      16
TASIG 90 H2001   2  -1   1       2   1  34   2              -1
TASIG 90 S1001  31   1               8   5
TASIG 90 S2001  59   2   1   2  12   7


         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

b. Setup for Figure 2.6.

Figure 2.7. A comparison of card setups to produce Figures 2.2 and 2.6.

```
KANGITLOTANAK 11, LABRADOR  WENNER 1947                    EXCLUDED FROM COUNT: CYP ERI SPH

DEPTH =   6.0 CM

                COUNT                    PERCENT
              228                        228

ACE
ALN             41                        18
BET             31                        14
CAP
CON            137                        60
FAG
QUE
SAL              1                        .4
TLA
ULM

ARB
ART
CER
COM
COR
DRO
EPI
EQU
GRA
LIN
LCH
MYR
NYM
PED
POL
RUB
SAN
SPA
PLA
SED

CYP             67                        29
ERI              2                        .9
FIL              2                        .9
LYC             16                         7
LYS
SPH              2                        .9
TIL
```

```
DEPTH
KANGITLOTANAK 11, LABRADOR  WENNER 1947                    CYP ERI SPH

KANGI    T   1 ACE ALN BET CAP CON FAG QUE SAL TLA ULM
KANGI    H   1 ARB ART CER COM COR DRO EPI EQU GRA LIN LCH MYR NYM PED POL RUB
KANGI    H   2 SAN SPA PLA SED
KANGI    S   1 CYP ERI FIL LYC LYS SPH TIL

KANGI  6 .0
KANGI  6 T   1      41  31     137          1
KANGI  6 H   1
KANGI  6 S   1  67   2   2  16       2
```

Figure 2.8. POLDATA output for a sample from previously published data.

S1 T3 IBP TRAPS

EXCLUDED FROM COUNT: CYP ERI SPH

TAUBER TRAP 2 SLIDE WT = .0158 GRAMS TREATED SAMPLE WT = .0834 GRAMS SAMPLE AREA= 19.64 SQ CM

4.40 TRAVERSES MICROSCOPE LS SLIDE 40 POWER 40 NO. OF TRAV. POSSIBLE = 87.9 SPIC = 2174 SPIN = 555

	COUNT			PERCENT			ABS/TRAP		ABS/SQ CM	
	100	200	300	100	200	300	300	SCAN	300	SCAN
ALN	6	15	18	6	7	6	1898		97	
BET	21	45	76	21	22	25	8014		408	
PIC	45	90	127	45	45	42	13392	11475	682	584
PIN	15	26	37	15	13	12	3902	2930	199	149
SAL	2	5	7	2	2	2	738		38	
ELE										
JUG			SCAN			SCAN	SCAN		SCAN	
TIL										
ULM										
FRA										
THU										
TSU										
EPH										
AMB			SCAN			SCAN	SCAN		SCAN	
ART										
CAR										
CHE	1	1	2	1	.5	.7	211		11	
COM										
CRU										
EPI	4	6	15	4	3	5	1582		81	
GRA			SCAN			SCAN	SCAN		SCAN	
LEG										
MYR		1	1		.5	.3	105		5	
POT			1			.3	105		5	
ROS										
RUB	5	9	13	5	4	4	1371		70	
SAR		1	1		.5	.3	105		5	
SAX										
TYF										
PHL										
PLA										
PLM										
POL										
RAN										
CEN										
THA										
UMB										
CYP	1	9	10	1	4	3	1054		54	
ERI	22	44	71	22	22	24	7487		381	
FIL										
LYC	1	1	2	1	.5	.7	211		11	
PLD										
PTE										
SPH	34	73	123	34	36	41	12970		660	
SEL										
LYS										
POY										
XXL										

FORT CHIMO POLSTERS, LABRADOR 1975 EXCLUDED FROM COUNT: CYP ERI XXE HYLOCOMIUM

CHIMO 1 SLIDE WT = .0579 GRAMS TREATED SAMPLE WT = .2416 GRAMS SAMPLE WT = .2389 GM

3.69 TRAVERSES MICROSCOPE LS SLIDE 40 POWER 40 NO. OF TRAV. POSSIBLE = 87.9 SPIC = 578 SPIN = 60

EXOTIC TRACER= 16100 PERCENTAGE RECOVERY = 71.6

	COUNT	PERCENT	ABS/GM	
	100	100	100	SCAN
ALN	14	14	8134	
BET	11	11	6391	
PIC	34	34	19753	14097
PIN	3	3	1743	1463
SAL	12	12	6972	
AMB	1	1	581	
ART	2	2	1162	
CAR	1	1	581	
CHE	SCAN	SCAN	SCAN	
COT	SCAN	SCAN	SCAN	
EPI	SCAN	SCAN	SCAN	
GRA	8	8	4648	
LEG	8	8	4648	
MYR	SCAN	SCAN	SCAN	
ROS	3	3	1743	
CYP	6	6	3486	
ERI	SCAN	SCAN	SCAN	
FIL	1	1	581	
LYC	SCAN	SCAN	SCAN	
SEL	2	2	1162	
XXE	116	116	67392	

Figure 2.10a. POLDATA output for a polster sample.

FORT CHIMO POLSTERS, LABRADOR 1975 HYLOCOMIUM

CHIMO 1 SLIDE WT = .0579 GRAMS TREATED SAMPLE WT = .2416 GRAMS SAMPLE WT = .2389 GM

3.69 TRAVERSES MICROSCOPE LS SLIDE 40 POWER 40 NO. OF TRAV. POSSIBLE = 87.9 SPIC = 578 SPIN = 60

	COUNT	PERCENT	ABS/GM		
	100	100	100	SCAN	106
ALN	14	14	5825		13
BET	11	11	4577		10
PIC	34	34	14146	10096	32
PIN	3	3	1248	1048	3
SAL	12	12	4993		11
AMB	1	1	416		.9
ART	2	2	832		2
CAR	1	1	416		.9
CHE	SCAN	SCAN	SCAN		SCAN
COT	SCAN	SCAN	SCAN		SCAN
EPI	SCAN	SCAN	SCAN		SCAN
GRA	8	8	3329		8
LEG	8	8	3329		8
MYR	SCAN	SCAN	SCAN		SCAN
ROS	3	3	1248		3
CYP	6	6	2496		6
ERI	SCAN	SCAN	SCAN		SCAN
FIL	1	1	416		.9
LYC	SCAN	SCAN	SCAN		SCAN
SEL	2	2	832		2

Figure 2.10b. POLDATA output for the same sample run without exclusions and omitting the exotic tracer.

```
CARD COLUMN:
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890


FORT CHIMO POLSTERS, LABRADOR  1975                                CYP ERI XXE
GM        WT
CHIMO     T    1 ALN BET PIC PIN SAL
CHIMO     H    1 AMB ART CAR CHE COT EPI GRA LEG MYR ROS
CHIMO     S    1 CYP ERI FIL LYC SEL XXE

CHIMO  1 .0579.2416.2389 3.69LS404087.9  578  60  16100          HYLOCOMIUM
CHIMO  1 T1001   14   11   34    3   12
CHIMO  1 H1001    1    2    1   -1   -1   -1    8    8   -1    3
CHIMO  1 S1001    6   -1    1   -1    2  116


         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

a. Setup for Figure 2.10a.

```
CARD COLUMN:
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890


FORT CHIMO POLSTERS, LABRADOR  1975
GM        WT
CHIMO     T    1 ALN BET PIC PIN SAL
CHIMO     H    1 AMB ART CAR CHE COT EPI GRA LEG MYR ROS
CHIMO     S    1 CYP ERI FIL LYC SEL

CHIMO  1 .0579.2416.2389 3.69LS404087.9  578  60                 HYLOCOMIUM
CHIMO  1 T1001   14   11   34    3   12
CHIMO  1 H1001    1    2    1   -1   -1   -1    8    8   -1    3
CHIMO  1 S1001    6   -1    1   -1    2  116


         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

b. Setup for Figure 2.10b.

Figure 2.11. A comparison of card setups to produce Figures 2.10a and b.

ROSE ISLAND,LABRADOR EXCLUDED FROM COUNT: CYP ERI SPH XXL

BAND 7-8 SLIDE WT = .0571 GRAMS TREATED SAMPLE WT = .4616 GRAMS SAMPLE VOL =15.0000 CC

4.60 TRAVERSES MICROSCOPE LS SLIDE 40 POWER 40 NO. OF TRAV. POSSIBLE = 87.9

EXOTIC TRACER= 37500 PERCENTAGE RECOVERY = 66.7

	COUNT			PERCENT			ABS/CC
	100	200	300	100	200	300	300
ALN	27	53	76	27	26	25	1173
BET	39	74	107	39	37	36	1651
PIC	4	8	14	4	4	5	216
PIN			2			.7	31
SAL	5	11	17	5	5	6	262
ART							
CAR	1	2	3	1	1	1	46
CHE							
COL							
COT							
EPI							
GRA	20	43	65	20	21	22	1003
MYR		1	2		.5	.7	31
POL		1	1		.5	.3	15
ROS		1	1		.5	.3	15
CYP	4	6	10	4	3	3	154
ERI	156	312	468	156	156	156	7222
FIL	2	2	5	2	1	2	77
LYL	2	4	6	2	2	2	93
LYS			1			.3	15
SPH							
XXL	53	107	162	53	53	54	2500

DEPTH OPTION SELECTED

Figure 2.12. Good distribution across subtotals.

ROSE ISLAND,LABRADOR EXCLUDED FROM COUNT: CYP ERI SPH XXL

BAND 3 SLIDE WT = .0472 GRAMS TREATED SAMPLE WT = .5167 GRAMS SAMPLE VOL =10.0000 CC

.56 TRAVERSES MICROSCOPE LS SLIDE 40 POWER 40 NO. OF TRAV. POSSIBLE = 87.9

EXOTIC TRACER= 37500 PERCENTAGE RECOVERY =160.4

	COUNT			PERCENT			ABS/CC
	100	200	300	100	200	300	300
ALN	10	17	40	10	8	13	4286
BET	63	119	159	63	59	53	17036
PIC	2	10	24	2	5	8	2571
PIN			1			.3	107
SAL	3	16	24	3	8	8	2571
ART							
CAR		2	2		1	.7	214
CHE							
COL							
COT							
EPI							
GRA	21	35	47	21	17	16	5036
MYR							
POL							
ROS	1	1	3	1	.5	1	321
CYP	13	33	65	13	16	22	6964
ERI	59	108	149	59	54	50	15964
FIL							
LYL							
LYS							
SPH		1	2		.5	.7	214
XXL	10	15	35	10	7	12	3750

Figure 2.13. Poor distribution across subtotals.

```
CARD COLUMN:
        1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890


SAL GRA ALN BET FRA PIC PIN ULM ART CAR CHE COM CRU EPI MYR POT RAN ROS RUB TYP
SAX CYP ERI FIL SPH -
WINDY LAKE, BAFFIN ISLAND
  7 21 26
 26
WNDLA    0S1001      16
WNDLA    0A1001     263    6177                                16
WNDLA    0A1002                      131
WNDLA    0A1003                                                66      131
WNDLA    0A1004
WNDLA    0R1001   4  94              -1                    2
WNDLA    0R1002                      1    2
WNDLA   25S1001      12
WNDLA   25A1001     586    4004      49       98             12
WNDLA   25A1002              49                              98
WNDLA   25A1003                                             146       49
WNDLA   25A1004
WNDLA   25R1001  12  82   1   2      -1                 1               2
WNDLA   25R1002                      3    1
WNDLA   50S1001       8      73
WNDLA   50A1001     986    8286      99                      8       73
WNDLA   50A1002              395
WNDLA   50A1003                                             296
WNDLA   50A1004
WNDLA   50R1001  10  84   1         -1    1            4
WNDLA   50R1002                      3


        1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

a. Before sorting.

```
CARD COLUMN:
        1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890


WNDLA    0A1001     263    6177                                16
WNDLA    0A1002                      131
WNDLA    0A1003                                                66      131
WNDLA    0A1004
WNDLA   25A1001     586    4004      49       98             12
WNDLA   25A1002              49                              98
WNDLA   25A1003                                             146       49
WNDLA   25A1004
WNDLA   50A1001     986    8286      99                      8       73
WNDLA   50A1002              395
WNDLA   50A1003                                             296
WNDLA   50A1004
WNDLA    0R1001   4  94              -1                    2
WNDLA    0R1002                      1    2
WNDLA   25R1001  12  82   1   2      -1                 1               2
WNDLA   25R1002                      3    1
WNDLA   50R1001  10  84   1         -1    1            4
WNDLA   50R1002                      3
WNDLA    0S1001      16
WNDLA   25S1001      12
WNDLA   50S1001       8      73


        1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

b. Data cards only, after sorting.

Figure 2.14. Card output from POLDATA.

```
C    POLDATA
C
C    PROGRAM TO CONVERT RAW COUNT DATA TO RELATIVE AND ABSOLUTE DATA
C
C    DEVELOPED IN 1974-75 BY MARGARET M. ECCLES
C    UNDER THE DIRECTION OF MARGARET HICKEY
C
C CARD SETUP REQUIRED
C
C    1  OPTION CARDS (COLUMNS 1-5)
C      PUNCH     FOR PUNCHED OUTPUT
C      DEPTH     TO INDICATE PROFILE SAMPLES
C      TRAP      TO INDICATE SAMPLES FROM TRAPS
C      NOTE: DEPTH AND TRAP CANNOT BE USED TOGETHER
C    2  TITLE CARD
C      COLS  1-60    ALPHANUMERIC TITLE TO APPEAR AT TOP OF EACH PAGE
C           61-80    UP TO 5 NAMES INDICATING POLLEN TYPES TO BE EXCLUDED
C                    FROM COUNTS.  TO EXCLUDE ALL TAXA ON LAST CARD,
C                    PUNCH S IN COLUMN 62.
C             (NOTE: IF COLS. 61-64 CONTAIN THE WORD SAME, CARDS 3 - 5 MAY
C                    BE ELIMINATED.  ALL INFORMATION PROVIDED BY THESE
C                    CARDS WILL BE ASSUMED TO BE THE SAME AS FOR THE
T                   PRECEDING SITE.
C             ALSO, IF MORE THAN 5 EXCLUSIONS ARE NEEDED, PUNCH THE WORD
C                    MOR IN COLUMNS 78-80 AND INCLUDE ANOTHER CARD WITH
C                    THE REMAINDER OF TAXA NAMES, BEGINNING WITH COLUMN 2
C                   INSTEAD OF COLUMN 62.  UP TO 24 TAXA MAY BE EXCLUDED.
C             WARNING - IF A TITLE CARD CONTAINS T,H,S, OR . IN
C               COLUMN 10 IT IS LIKELY TO BE INTERPRETED AS A
C               DATA CARD OR LEVEL HEADER CARD WHEN READ AS THE
C               SECOND (OR MORE) SITE IN A STACKED SEQUENCE.
C    3  UNIT CARD
C      COLS  1 - 6 NAME OF UNITS (E.G. CC, GM, SQ.CM.)
C                  (BLANK UNIT INDICATES NO ABSOLUTE TO BE CALCULATED)
C           11-14 TYPE OF UNITS  (E.G. VOL, WT, AREA)
C    4  NAME CARDS
C      COLS  1- 5    IDENTIFICATION FOR THIS SITE
C              10    FLAG (T=TREES, H=HERBS, S=SPORES)
C              14    CARD NUMBER
C           16-18    NAME OF FIRST POLLEN TYPE
C           20-22    NAME OF SECOND POLLEN TYPE
C           24-26    NAME OF THIRD POLLEN TYPE
C             ...    ...
C         FOR UP TO 16 TYPES
C    5  REORDERING
C      IF REORDERING IS NOT DESIRED, INSERT ONE BLANK CARD.  OTHERWISE,
C      AT LEAST TWO CARDS ARE REQUIRED.
C            1) NUMBER OF ITEMS TO BE REORDERED, PUNCHED IN COLS. 2 - 3
C               (THIS PERMITS ELIMINATION OF UNWANTED TAXA)
C            2) LIST OF NEW ORDER, BEGINNING IN COL.1, WITH NUMBERS
C               SEPARATED BY COMMAS, E.G. 1,2,5,10,4,6
C               (NOTE: IT IS ASSUMED THAT REORDERING WILL NOT
C               CHANGE THE POSITION OF THE FIRST TAXON IN THE
C               THIRD (SPORE) GROUP RELATIVE TO THAT GROUP)
C    6  SLIDE HEADER CARD
C      COLS  1- 5    IDENTIFICATION FOR THIS SITE
C            6- 9    FOR DEPTH SAMPLES, DEPTH IN MM
C                    FOR OTHER SAMPLES, SAMPLE IDENTIFICATION
C           (NOTE: IF NEITHER TRAP NOR DEPTH OPTION IS
C                  SELECTED, COLS. 1 - 9 WILL BE PRINTED AS
C                  THE SLIDE IDENTIFICATION.)
C           10-14    SLIDE WEIGHT IN GRAMS
```

```
C          (NOTE: DECIMAL POINT MUST BE IN COLUMN 10)
C          15-19   TREATED SAMPLE WEIGHT
C          20-24   SAMPLE WEIGHT,AREA OR VOLUME
C          25-29   NUMBER OF TRAVERSES
C          30-31   MICROSCOPE TYPE
C          32-33   SLIDE LE''GTH
C          34-35   MICROSCOPE POWER
C          36-40   NUMBER OF POSSIBLE TRAVERSES
C          41-44   SCAN COUNT FOR SPRUCE
C          45-48   SCAN COUNT FOR PINE
C          51-55   NUMBER OF EXOTIC TRACER GRAINS ADDED
C          66-80   TYPE OF MOSS POLSTER
C   7  DATA CARDS
C     COLS  1- 5   IDENTIFICATION AS FOR LEVEL HEADER CARD
C           6- 9   IDENTIFICATION AS FOR LEVEL HEADER CARD
C             10   FLAG AS FOR NAME CARDS
C          11-13   COUNT (-1 FOR SCANS)
C             14   CARD NUMBER
C          15-18   VALUE FOR FIRST POLLEN TYPE
C          19-22   VALUE FOR SECOND POLLEN TYPE
C          23-26   VALUE FOR THIRD POLLEN TYPE
C            ...     ...
C        FOR UP TO 16 TYPES
C  6 - 7 MAY BE REPEATED FOR AS MANY SLIDES AS DESIRED.
C  2 - 7 MAY BE REPEATED FOR AS MANY SITES AS DESIRED. USING THE SAME
C        OPTIONS AS THE PREVIOUS SITE.
C   TO INCLUDE A SITE WITH DIFFERENT OPTIONS, INSERT AN END-OF-RECORD
C        CARD AND REPEAT 1 - 7.
C
      PROGRAM POLDATA(INPUT,OUTPUT,PUNCH,TAPE5=INPUT)
      DIMENSION NOPT(3),IA(8),TITLE(6),EXCL(5),EXC2(20),
     .IXCL(96),IX(16),KOUNT(3),KNT(3),KK(3,96),MISS(3),
     .PK(3),PCT(3),A(3),P(96),ABS(96),SPP(8),N1(6),N2(6)
      COMMON IOPT(3),N,PNAME(96)
      COMMON /MISC/G,X,TRORIG
      COMMON /S/ ISP,SPIC,SPIN,Y
      COMMON /U/ UNIT,UTYPE
      DATA NOPT/5HPUNCH,5HDEPTH,5HTRAP /
      EQUIVALENCE (IOPT(1),IPUNCH),(IOPT(2),IDEPTH),(IOPT(3),ITRAP)
C**********************
C        READ OPTION CARDS (IF ANY), TITLE CARD, AND UNIT
C        CARD
    1 IPUNCH=IDEPTH=ITRAP=N=0
      EXC2=1H
   10 READ 11,IA
   11 FORMAT (8A10)
      IF (EOF,5) 900,15
   15 DO 20 I=1,3
      IF (IA.NE.NOPT(I)) GO TO 20
      IOPT(I)=1
      PRINT 17,NOPT(I)
   17 FORMAT (1H0,A6,*OPTION SELECTED*)
      GO TO 10
   20 CONTINUE
   30 CONTINUE
      DECODE (80,31,IA) TITLE,EXCL
   31 FORMAT (6A10,X,4A4,A3)
      IF (EXCL.NE.4HSAME) GO TO 40
      IF (N.EQ.0) 910,160
   40 CONTINUE
      IF(EXCL(5).EQ.3HMOR) READ 42,EXC2
   41 FORMAT (1H0,13A10)
   42 FORMAT(X,19A4,A3)
      READ 31,UNIT,UTYPE
C        READ NAME CARDS
      CALL RNAMES(ITRACE,N1,N2)
C         READ CARDS TO SPECIFY REORDERING.
C         BLANK CARD INDICATES NONE
```

```
      CALL NEWORD(NPUNCH)
C          LOCATE SPRUCE (PIC) AND PINE (PIN) IN NAME LIST
      CALL SETSPCN(IPIC,IPIN)
C        CHECK FOR NAMES TO BE EXCLUDED FROM COUNTS
      CALL EXCLUDE(IXCL,IXC,EXCL,N1(3))
      IF (IPUNCH.EQ.0) GO TO 190
C        INITIALIZE PUNCH FORMAT AND TRACER NUMBER
      CALL PFORM
      IF (NPUNCH.GT.0) N=NPUNCH
      IF (ITRACE.NE.0) ITRACE=NEWI(ITRACE)
C        PRESET UNUSED PORTION OF ARRAYS FOR PUNCHING
      DO 120 I=3,8
  120 SPP(I)=1H
      DO 130 I=N,96
  130 ABS(I)=P(I)=1H
  160 CONTINUE
C          PUNCH TITLE, ETC.  IF PUNCH OPTION IS SELECTED
      PUNCH 31,TITLE
      PUNCH 171,(N2(I),I=1,3),NPUNCH
  171 FORMAT (3I3)
  190 CONTINUE
C          READ A CARD.  FIRST ONE MUST BE LEVEL HEADER CARD
      CALL RCARD(IA,J)
C        J SPECIFIES TYPE OF CARD
C          POSITIVE FOR DATA CARD
C          0 FOR SLIDE HEADER CARD
C          NEGATIVE FOR NEITHER
      IF (J) 900,200,920
C$$$$$$$$$$$$$$$$$$$$
C        BEGIN NEW SITE OR LEVEL
C        SLIDE HEADER CARD
C        PRINT TITLE AND EXCLUSIONS (IF ANY) AT TOP OF PAGE
  200 PRINT 211,TITLE
  211 FORMAT (1H1,6A10)
      IF (IXC.EQ.0) GO TO 250
      IF (EXCL(5).EQ.3HMOR) GO TO 240
      PRINT 212,EXCL
  212 FORMAT (1H+,65X,*EXCLUDED FROM COUNT:*,X,12A4)
      GO TO 250
  240 PRINT 212,(EXCL(I),I=',4),(EXC2(I),I=1,8)
      IF (EXC2(9).EQ.1H ) GO TO 250
      PRINT 241,(EXC2(I),I=9,20)
  241 FORMAT (87X,12A4)
  250 CONTINUE
C        PRINT SLIDE INFORMATION
      CALL PRHEAD(IA)
C          ZERO COUNT ARRAYS
  280 DO 290 I=1,3
      KNT(I)=0
      KOUNT(I)=0
      DO 290 JJ=1,N
  290 KK(I,JJ)=0
      KMAX=0
      K=0
C        READ ANOTHER CARD
      CALL RCARD(IA,J)
      IF (J) 900,200,300
C**********************
C                DATA CARD
  300 DECODE (78,301,IA(2)) KL,IC,IX
  301 FORMAT (I3,I1,16I4)
C        DETERMINE NUMBER OF SUBTOTALS FOR THIS SLIDE
      IF (KMAX.EQ.0) GO TO 320
C        CHECK FOR MATCH WITH LIST OF SUBTOTALS
      DO 310 K=1,KMAX
      IF (KL.EQ.KOUNT(K)) GO TO 330
  310 CONTINUE
C        NO MATCH. CHECK NUMBER OF SUBTOTALS
```

```
C        NO MORE THAN THREE SUBTOTALS PER SLIDE
      IF (KMAX.LT.3) GO TO 320
      PRINT 311,KL,KOUNT
  311 FORMAT (1H0,100X,*TOO MANY COUNTS*,4I5)
      GO TO 350
  320 CONTINUE
C        ADD A SUBTOTAL TO THE LIST
      KMAX=KMAX+1
      K=KMAX
      KOUNT(K)=KL
  330 CONTINUE
C        J=GROUP NUMBER (DETERMINED IN SUBROUTINE RCARD)
      IF (IC.EQ.2) J=J+3
      NM=N1(J)
      NN=N2(J)
      L=0
C        INCREMENT TOTAL COUNTER AND STORE POLLEN COUNT
      DO 340 II=NM,NN
      L=L+1
C        I IS THE NEW ORDER NUMBER. I=-1 MEANS TAXON IS TO BE SKIPPED.
      I=NEWI(II)
      IF (I.LE.0) GO TO 340
C        SKIP TAXA WITH NAME DESIGNATED AS  -
      IF (PNAME(I).EQ.1H-) GO TO 340
C        DO NOT ACCUMULATE SCANS OR EXCLUDED TYPES
      IF (IX(L).LT.0) GO TO 335
      IF (IXCL(I).EQ.1) GO TO 335
      KNT(K)=KNT(K)+IX(L)
  335 KK(K,I)=IX(L)
  340 CONTINUE
C**********************
C        READ ANOTHER CARD. IF NOT A DATA CARD, PREPARE
C        OUTPUT
  350 CALL RCARD(IA,J)
      IF (J.GT.0) GO TO 300
      IF (ITRACE.EQ.0) GO TO 360
C        CALCULATE AND PRINT PERCENTAGE RECOVERY
      TABS=X*KK(KMAX,ITRACE)
      IF (TABS.LE.0.) GO TO 360
C        TRORIG IS AMOUNT OF TRACER ADDED
      IF (TRORIG.EQ.0) GO TO 360
C        TPG IS TRACER ADDED PER UNIT MEASUREMENT
      TPG=TRORIG/G
      RECOV=TABS*100./TPG
      PRINT 354,TRORIG,RECOV
  354 FORMAT (*0EXOTIC TRACER=*,F6.0,5X,*PERCENTAGE RECOVERY =*,F5.1)
      TABS=TPG/TABS
      IF (ISP.NE.0) Y=Y*TABS
      X=X*TABS
  360 CONTINUE
C        PREPARE AND PRINT HEADING
      IF (UNIT.EQ.1H ) KOUNT(KMAX)=KNT(KMAX)
      CALL PRHEAD2(KOUNT,KMAX)
C        DO NOT CHECK COUNT FOR SCAN ONLY (SUBTOTAL = -1)
C           OR IF UNIT IS BLANK
      L=0
      IF (KOUNT.LT.0) GO TO 385
      IF (UNIT.EQ.1H ) GO TO 385
C        CHECK TOTAL COUNT
      DO 380 I=1,KMAX
      MISS(I)=0
      IF (KNT(I).EQ.KOUNT(I)) GO TO 380
      L=L+1
      MISS(L)=I
      IX(L)=KNT(I)
  380 CONTINUE
C        PRINT EXTRA COLUMNS IF TOTAL DOES NOT CHECK
      IF (L.GT.0) PRINT 381,(IX(I),I=1,L)
  381 FORMAT (1H+,105X,3I6)
  385 CONTINUE
```

```
C          PRESET PRINT FIELDS TO BLANK
      DO 390 JJ=1,3
      PCT(JJ)=PK(JJ)=A(JJ)=1H
  390 CONTINUE
      ABS(I)=1H
      IN=1
C+++++++++++++++++++++++
C          LOOP THROUGH POLLEN TYPES
  400 DO 580 I=1,N
      IF (I.NE.NEWI(N1(IN))) GO TO 410
C          SKIP A LINE BETWEEN GROUPS
      PRINT 31
      IN=IN+1
  410 CONTINUE
C          SKIP THOSE TAXA WITH NAME DESIGNATED AS  -
      IF (PNAME(I).EQ.1H-) GO TO 580
C----------------------
C          LOOP THROUGH SUBTOTALS
      IX=0
      DO 420 K=1,KMAX
      XX=KK(K,I)
      IF (XX.EQ.0.) GO TO 420
      IX=1
C          CONVERT TO PRINT CODE
      CALL CODE(XX,PK(K))
C          CALCULATE PERCENTAGE
      PCT(K)=PERCENT(XX,KOUNT(K))
  420 CONTINUE
C          END OF LOOP THROUGH SUBTOTALS
C----------------------
C          PRINT COUNTS FOR POLLEN TAXA
C          STORE HIGHEST SUBTOTAL FOR CARD OUTPUT
      P(I)=PCT(KMAX)
C       DO NOT CALCULATE ABSOLUTE IF UNIT IS BLANK
      IF (UNIT.EQ.1H ) GO TO 500
      IF (IX.EQ.0) GO TO 450
      XX=KK(KMAX,I)
      XX=XX*X
      CALL CODE  (XX,ABS(I))
      IF (ITRAP.EQ.0) GO TO 450
C          CALCULATE ABSOLUTE COUNT PER UNIT FOR TRAPS
C          G=1.0 MEANS SAMPLE SIZE UNKNOWN -- DO NOT CALCULATE ABSOLUTE
      IF (G.EQ.1.0) GO TO 450
      CALL CODE(XX/G,A(2))
  450 CONTINUE
      IF (ISP.EQ.0) GO TO 500
C          IF SCAN, CHECK FOR SPRUCE OR PINE
      IF (I.NE.IPIC.OR.SPIC.EQ.0.) GO TO 460
C          PINE
      NSP=1
      SP=SPIC
      IX=1
      GO TO 480
  460 IF (I.NE.IPIN.OR.SPIN.EQ.0.) GO TO 500
C          SPRUCE
      NSP=2
      SP=SPIN
      IX=1
  480 CONTINUE
      IF (SP.EQ.0.) GO TO 500
C          IF PRESENT, CALCULATE ABSOLUTE COUNT FOR SCAN
      IF (P(I).EQ.1H ) ABS(I)=1H
      SP=Y*SP
      CALL CODE(SP,A)
      SPP(NSP)=A
      IF (ITRAP.EQ.0) GO TO 500
      IF (G.EQ.1.0) GO TO 500
      CALL CODE(SP/G,A(3))
      SPP(NSP)=A(3)
C**********************
```

```
C         PRINT A LINE OF OUTPUT
  500 CONTINUE
      IF (IX.EQ.0) GO TO 570
      PRINT 501,PNAME(I),PK,PCT,ABS(I),(A(K),K=1,3)
  501 FORMAT (2X,A8,3R6,6X,3R6,4X,4A10)
      IF (L.EQ.0) GO TO 550
C      COMPUTE AND PRINT PERCENTAGE BASED ON SUM IF TOTAL DOES NOT CHECK
      DO 520 JJ=1,L
      K=MISS(JJ)
      XX=KK(K,I)
      PCT(JJ)=PERCENT(XX,KNT(K))
      IF (KNT(K).EQ.KMAX.AND.IPUNCH.EQ.1) P(I)=PCT(JJ)
  520 CONTINUE
      PRINT 521,(PCT(JJ),JJ=1,L)
  521 FORMAT (1H+,105X,3R6)
  550 CONTINUE
C         FOR TRAP SAMPLES, REPLACE ABSOLUTE COUNT PER TRAP
C           WITH ABSOLUTE COUNT PER UNIT OF MEASUREMENT
      IF (ITRAP.NE.0) ABS(I)=A(2)
C         RESET PRINT FIELDS TO BLANK
      DO 560 JJ=1,3
  560 PK(JJ)=PCT(JJ)=A(JJ)=1H
      GO TO 580
  570 CONTINUE
      PRINT 501,PNAME(I)
      ABS(I)=1H
  580 CONTINUE
C         END OF LOOP THROUGH POLLEN TYPES
C++++++++++++++++++++++
C         PUNCH CARDS IF PUNCH OPTION SELECTED
      IF (IPUNCH.EQ.0) GO TO 600
C         IF UNIT IS BLANK PUNCH PERCENT ONLY
      IF (UNIT.EQ.1H ) GO TO 590
      IF (ISP.EQ.0) GO TO 585
C         PUNCH ABSOLUTE SPRUCE AND PINE SCAN (CODED S)
      CALL PPUNCH(1HS,KOUNT(KMAX),SPP,2,2)
C         REPLACE PICEA AND PINUS ABSOLUTE CALCULATIONS WITH
C           CALCULATIONS FROM SCAN COUNT (IF ANY)
      ABS(IPIC)=SPP(1)
      ABS(IPIN)=SPP(2)
      SPP(1)=SPP(2)=1H
C         DO NOT PUNCH REST OF CARDS IF SCAN ONLY
      IF (KOUNT.LT.0) GO TO 600
  585 CONTINUE
C         DO NOT PUNCH TRACER
      IF (ITRACE.NE.0) ABS(ITRACE)=P(ITRACE)=1H
C         PUNCH ABSOLUTE (CODED A)
      CALL PPUNCH(1HA,KOUNT(KMAX),ABS,N,2)
  590 CONTINUE
C         PUNCH PERCENTS (CODED R)
      CALL PPUNCH(1HR,KOUNT(KMAX),P,N,1)
  600 CONTINUE
C         END OF SITE OR LEVEL
C$$$$$$$$$$$$$$$$$$$$$
      IF (J.GE.0) GO TO 200
      PRINT 611
  611 FORMAT (1H1)
      IF (J.EQ.-9) 1,30
  900 STOP
C         ERROR MESSAGES
  910 PRINT 911
  911 FORMAT (*0SAME OPTION ON TITLE CARD CANNOT BE USED ON FIRST SITE*)
      STOP
  920 PRINT 921
  921 FORMAT (*1LEVEL HEADER CARD MISSING*)
  930 CALL RCARD(IA,J)
      IF (J) 900,200,930
      END
```

```
C
C**********************
C
      SUBROUTINE RNAMES(ITRACE,N1,N2)
C       SUBROUTINE TO READ NAME CARDS, CHECK THEIR SEQUENCE,
C         AND LOCATE THE EXOTIC TRACER (IF ANY)
      COMMON IDUM(3),N.PNAME(96)
      COMMON /P/ LOC,SITE,PTYPE
      DIMENSION A(16),N1(6),N2(6)
      DIMENSION FN(3)
      DATA FN/1HT,1HH,1HS/
      DATA TMASK/7777000000000000000B/
C
      IFN=IN=ITRACE=0
C         NAME CARDS MUST BE IN THE SEQUENCE T,H,S (FLAG)
   50 READ 51,LOC,FLAG,IC,A
   51 FORMAT (A5,4X,A1,3X,I1,X,15A4,A3)
      IF (IC.EQ.0) IC=1
      IF (IC.EQ.1) IFN=IFN+1
      IF (FLAG.NE.FN(IFN)) GO TO 910
      J=IFN
C         TWO CARDS ARE ALLOWED FOR H
      IF (IC.EQ.2) J=J+3
C        N1 IS THE NUMBER OF THE FIRST TAXON IN EACH GROUP
      N1(J)=IN+1
      DO 60 I=1,16
C        IF NAME IS BLANK GO ON TO NEXT GROUP
      IF (A(I).EQ.1H    ) GO TO 70
C
      IN=IN+1
      PNAME(IN)=A(I)
C        SAVE NUMBER OF TRACER IN ITRACE
C        TRACER NAME MUST ALWAYS BEGIN WITH XX
C        (NOTE: IF MORE THAN ONE NAME BEGINS WITH XX
C              THE LAST ONE IS USED)
      IF ((A(I) .AND.TMASK ).EQ.2LXX) ITRACE=IN
   60 CONTINUE
C        N2 IS THE NUMBER OF THE LAST TAXON IN EACH GROUP
   70 N2(J)=IN
      IF (IFN.LT.3) GO TO 50
C        N=NUMBER OF POLLEN TYPES
      N=IN
   80 RETURN
  910 PRINT 911,LOC,FLAG,FN(IFN),IFN
  911 FORMAT (*0CHECK NAME CARDS FOR *,A8,A2,*FOUND INSTEAD OF *,A1,I5)
      IF (IFN.EQ.3) 80,50
      END
C
C**********************
C
      FUNCTION NEWI(N)
C    FUNCTION TO RETURN REORDERED INDEX NUMBER
      DIMENSION IORD(96),Y(96),NORD(96)
      COMMON IPUNCH,IDUM(3),PNAME(96)
C
      NEWI=N
      IF (IPUNCH.EQ.0) RETURN
      IF (IORD.EQ.0) RETURN
      NEWI=NORD(N)
      RETURN
C
C    ENTRY POINT NEWORD READS IN REORDERING INFORMATION
C    AND REORDERS NAMES
C         NOTE: NEWORD IS CALLED AS A SUBROUTINE
C
      ENTRY NEWORD
      READ 11,N
   11 FORMAT (25I3)
      IF (N.GT.0) GO TO 20
```

```
      IORD=0
      RETURN
   20 CONTINUE
      IF (N.GT.96) GO TO 910
C      READ NEW SEQUENCE
      READ    ,(IORD(I),I=1,N)
      PRINT 12
   12 FORMAT (*0REORDERED SEQUENCE IS AS FOLLOWS:*/)
      DO 40 I=1,96
   40 NORD(I)=-1
      DO 120 I=1,N
      J=IORD(I)
      Y(I)=PNAME(J)
      NORD(J)=I
  120 CONTINUE
C      PRINT NEW SEQUENCE OF NAMES
      PRINT 121,(Y(I),I=1,N)
  121 FORMAT (2X,16A7)
      IF (IPUNCH.NE.0) GO TO 130
      PRINT 126
  126 FORMAT (*0PRINTED OUTPUT WILL HAVE TAXA IN ORIGINAL ORDER*)
      RETURN
C    PUT NAMES IN NEW SEQUENCE AND PUNCH
  130 DO 140 I=1,N
  140 PNAME(I)=Y(I)
      PUNCH 142,(Y(I),I=1,N)
  142 FORMAT (20A4)
      RETURN
C
  910 PRINT 911,N
  911 FORMAT (1H0,I4,* NAMES SPECIFIED FOR REORDERING -- MAXIMUM IS 96*)
      STOP
      END
C
C**********************
C
      SUBROUTINE PPUNCH(CODE,KOUNT,X,N,J)
C   SUBROUTINE TO PUNCH CARD OUTPUT
C   SCAN VALUES ARE CONVERTED TO -1
C        ENTRY POINT PFORM SETS FORMAT TO PUNCH ALPHABETIC
C        SITES OR NUMERIC LEVELS ACCORDING TO DEPTH OPTION
      COMMON IOPT,IDEPTH
      COMMON /P/ LOC,SITE,PTYPE
      DIMENSION X(55),FORM(5),NW(2),DEPTH(2),COUNT(2)
      DATA NW/16,8/,DEPTH/2HA4,4HF4.0/,COUNT/4H16R4,3H8R8/
      DATA FORM/4H(A5, , 1H  , 10H,A1,I3,I1, , 1H  , 4H,A2)/
      DATA SCAN/10H      SCAN/,PSCAN/10H        -1/
C
      DO 10 I=1,N
      IF (X(I).EQ.SCAN) X(I)=PSCAN
   10 CONTINUE
      FORM(4)=COUNT(J)
      K=NW(J)
      IC=1
      DO 50 I=1,N,K
      L=I+K-1
      PUNCH FORM,LOC,SITE,CODE,KOUNT,IC,(X(M),M=I,L),PTYPE
      IC=IC+1
   50 CONTINUE
      RETURN
C
C   ENTRY POINT PFORM INITIALIZES FORMAT FOR DEPTH OR NON-DEPTH
C
      ENTRY PFORM
      ID=1
      IF (IDEPTH.GT.0) ID=2
      FORM(2)=DEPTH(ID)
      RETURN
      END
C
```

```
C**********************
C
      SUBROUTINE SETSPCN(IPIC,IPIN)
C    SUBROUTINE TO LOCATE ORDER NUMBERS OF PINE (PIN) AND SPRUCE (PIC)
      COMMON IDUM(4),PNAME(96)
C
      K=IPIC=IPIN=0
      DO 50 I=1,N
      IF (PNAME(I).EQ. 3HPIC) GO TO 20
      IF (PNAME(I).EQ. 3HPIN) GO TO 30
      GO TO 50
   20 IPIC=I
      GO TO 40
   30 IPIN=I
   40 K=K+1
      IF (K.EQ.2) RETURN
   50 CONTINUE
      RETURN
      END
C
C**********************
C
      SUBROUTINE EXCLUDE(IXCL,IXC,EXCL,NN)
C    SUBROUTINE TO LOCATE TAXA TO BE EXCLUDED FROM THE COUNT
      DIMENSION IXCL(96),EXCL(5)
      COMMON IDUM(3),N,PNAME(96)
C
C        ZERO ARRAY TO INDICATE EXCLUDED POLLEN TYPES
      DO 80 I=1,N
   80 IXCL(I)=0
C        IXC IS ZERO IF THERE ARE NO EXCLUSIONS
      IXC=0
      IF (EXCL(1).EQ.4HS    ) GO TO 130
      DO 120 I=1,25
C        IF NAME IS BLANK GO ON TO NEXT SECTION
      IF (EXCL(I).EQ.1H ) RETURN
      IF (EXCL(I).EQ.3HMOR) GO TO 120
      IXC=1
      DO 100 J=1,N
      IF (EXCL(I).EQ.PNAME(J)) GO TO 110
  100 CONTINUE
      PRINT 101,EXCL(I),(PNAME(J),J=1,N)
  101 FORMAT (*0NO NAME FOUND TO MATCH *,A5,20A4/(30X,20A4))
      GO TO 120
  110 IXCL(J)=1
  120 CONTINUE
      RETURN
C        S IN COLUMN 62 INDICATES ALL SPORES TO BE EXCLUDED
  130 DO 140 J=NN,N
  140 IXCL(J)=1
      IXC=1
  150 CONTINUE
      RETURN
      END
C
C**********************
C
      SUBROUTINE RCARD(IA,J)
C   SUBROUTINE TO READ A CARD AND DETERMINE TYPE
C     VALUE OF J IS
C       0 IF SLIDE HEADER CARD (. IN COLUMN 10)
C       1 IF DATA CARD WITH T IN COLUMN 10
C       2 IF DATA CARD WITH H IN COLUMN 10
C       3 IF DATA CARD WITH S IN COLUMN 10
C      -9 IF END OF FILE
C      -1 IF NONE OF THE ABOVE
      DIMENSION IFLAG(3),IA(8)
      DATA IFLAG/1RT,1RH,1RS/
      DATA MASK/77B/
```

```
C
   10 READ 11,IA
   11 FORMAT (8A10)
      IF (EOF,5) 90,20
   20 CONTINUE
C    BLANK CARDS ARE IGNORED
      IF (IA.EQ.1H ) GO TO 10
      K=MASK.AND.IA
      IF (K.EQ.1R.) GO TO 50
      DO 30 I=1,3
      IF (K.EQ.IFLAG(I)) GO TO 40
   30 CONTINUE
C    OTHER
      J=-1
      RETURN
C    SL+DE HEADER CARD
   40 J=I
      RETURN
C    END OF RECORD
   50 J=0
      RETURN
   90 J=-9
      RETURN
      END
C
C**********************
C
      SUBROUTINE PRHEAD(IA)
C    SUBROUTINE TO INTERPRET AND PRINT INFORMATION FROM SLIDE HEADER CARD
      COMMON IPUNCH,IDEPTH,ITRAP
      COMMON /MISC/G,X,TRORIG
      COMMON /P/ LOC,SITE,PTYPE
      COMMON /S/ ISP,SPIC,SPIN,Y
      COMMON /U/ UNIT,UTYPE
      DIMENSION IA(8),TRAP(4),TYPE(2)
      DATA TRAP/6H TUFFY,6HTAUBER,5HHIRST,1H /
      DATA TMASK/777700000000000000008/
      EQUIVALENCE (SITE,ISITE)
C
  200 DECODE(80,201,IA) NAME,ISITE,SMALLA,BIGA,G,TRAV,MIC,
     .ISLIDE,IPOWER,TRVMX,SPIC,SPIN,TRORIG,TYPE
  201 FORMAT (A5,A4,4F5.0,A2,2I2,F5.2,2F4.0,F7.0,10X,A10,A5)
C         ISP=0 IF PINE AND SPRUCE COUNTS ARE BOTH ZERO
      ISP=SPIC+SPIN
C    PEAT TYPE (POLSTERS ONLY)
C     (TYPE IS FULL NAME AS INPUT, PTYPE IS SHORTENED FOR PUNCHED OUTPUT)
      PTYPE=1H
      IF (TYPE.EQ.1H ) GO TO 210
      PRINT 202,TYPE
  202 FORMAT (1H+,120X,A10,A5)
      PTYPE=TYPE(1)
  210 CONTINUE
      IF (IDEPTH.EQ.0) GO TO 220
C        PRINT LEVEL FOR PROFILE (DEPTH) SAMPLES
      DECODE (4,213,ISITE) DEPTH
  213 FORMAT (F4.1)
      PRINT 214,DEPTH
  214 FORMAT (8HODEPTH =,F6.1,* CM*)
      SITE=DEPTH*10.
      GO TO 240
C        PRINT SITE NAME FOR SINGLE FOSSIL SAMPLES
  220 IF (ITRAP.GT.0) GO TO 230
      PRINT 221,NAME,ISITE
  221 FORMAT (1H0,A5,A4)
      GO TO 240
C        PRINT TRAP AND WEIGHT INFORMATION FOR TRAP SAMPLES
C        SELECT TRAP TYPE LABEL
  230 ITRAP=4
```

```
      IF (ISITE.EQ.3HTFY) ITRAP=1
      IF ((ISITE.AND.TMASK).EQ.2LTT) ITRAP=2
      IF (ISITE.EQ.4HHRST) ITRAP=3
      NO=1H
C        FOR TAUBER TRAPS, NO IS TRAP NUMBER
      IF (ITRAP.EQ.2) NO=LLS(ISITE,12)
C        FOR OTHER TRAPS, NO IS SITE NAME
      IF (ITRAP.EQ.3) NO=ISITE
      PRINT 231,TRAP(ITRAP),NO,SMALLA,BIGA
  231 FORMAT (1H0,A6,6H TRAP ,A4,          *   SLIDE WT =*,
     .F7.4,* GRAMS  TREATED SAMPLE WT =*,F7.4,* GRAMS*)
      IF (G.NE.0.) PRINT 232,UTYPE,G,UNIT
  232 FORMAT (1H+,78X,*SAMPLE *,A4,1H=,F6.2,X,A6)
      GO TO 250
  240 CONTINUE
C        NO MORE TO PRINT IF UNIT IS BLANK
      IF (UNIT.EQ.1H ) RETURN
C        PRINT WEIGHT INFORMATION
      PRINT 241,SMALLA,BIGA,UTYPE,G,UNIT
  241 FORMAT (1H+,18X,*SLIDE WT =*,F7.4,* GRAMS  TREATED SAMPLE WT =*,
     .F7.4,* GRAMS  SAMPLE *,A4,1H=,F7.4,X,A6)
C         PRINT SLIDE INFORMATION
  250 IF (TRAV.EQ.0) GO TO 260
      IF (TRAV.EQ.G) GO TO 260
      PRINT 251,TRAV,MIC,ISLIDE,IPOWER,TRVMX
  251 FORMAT ( 1H0,F7.2,* TRAVERSES  MICROSCOPE *,A4.*SLIDE*,I3,
     .*  POWER*,I3,*  NO. OF TRAV. POSSIBLE =*,F7.1)
      GO TO 270
  260 PRINT 261,MIC,ISLIDE,IPOWER,TRVMX
  261 FORMAT (1H0,3X,*ALL TRAVERSES  MICROSCOPE *,A4.*SLIDE*,I3,
     .*  POWER*,I3,*  NO. OF TRAV. POSSIBLE =*,F7.1)
  270 CONTINUE
C        CALCULATE MULTIPLICATION FACTOR FOR REGULAR COUNTS
      XK=TRVMX/TRAV
      IF (TRAV.EQ.0.) XK=1.
      XN=BIGA/SMALLA
      IF (SMALLA.EQ.0.) XN=1.
      X=XK*XN
      IF (G.NE.0..AND.ITRAP.EQ.0) X=X/G
      IF (ISP.EQ.0) RETURN
C        CALCULATE MULTIPLICATION FACTOR FOR SCAN COUNTS
C           (ALL TRAVERSES COUNTED)
      Y=XN/G
      IF (ITRAP.NE.0) Y=XN
      PRINT 272,SPIC,SPIN
  272 FORMAT (1H+,100X,*SPIC =*,F5.0,*   SPIN =*,F5.0)
      RETURN
      END
C
C*********************
C
      SUBROUTINE PRHEAD2(KOUNT,KMAX)
C   SUBROUTINE TO CREATE COLUMN HEADINGS
      COMMON IPUNCH,IDEPTH,ITRAP
      COMMON /S/ ISP
      COMMON /U/ UNIT
      DIMENSION KOUNT(3),A(10)
      DATA BLANK/1H /,TRAP/4HTRAP/,A(1)/1H0/
C
  301 FORMAT (1H0/1H0,17X,5HCOUNT,18X,7HPERCENT,11X,
     .2(A6,4HABS/,A10))
      DO 310 I=1,10
  310 A(I)=BLANK
C   LINE 1
      IF (ITRAP.NE.0) GO TO 340
      IF (UNIT.NE.BLANK) GO TO 330
C   PERCENT ONLY
      PRINT 301
      GO TO 350
```

```
C    DEPTH AND SINGLE FOSSIL SAMPLES
  330 PRINT 301,BLANK,UNIT
      GO TO 350
C    TRAP SAMPLES
  340 PRINT 301,BLANK,TRAP,BLANK,UNIT
  350 CONTINUE
C    LINE 2
      IF (ISP.NE.0) A(8)=10H  SCAN
      IF (KOUNT.GT.0) GO TO 360
      A(2)=A(4)=A(7)=1H
      GO TO 370
  360 CONTINUE
C    COUNT COLUMN
      NC=6*KMAX
      ENCODE (NC,361,A(2)) (KOUNT(I),I=1,KMAX)
  361 FORMAT (3I6)
C    PERCENT COLUMN
      NC=NC+4
      ENCODE (NC,362,A(4)) (KOUNT(I),I=1,KMAX)
  362 FORMAT (4X,3I6)
C    IF UNIT IS BLANK REST OF LINE IS BLANK
      IF (UNIT.EQ.BLANK) GO TO 370
C    ABSOLUTE COLUMN
      ENCODE( 6,361,A(7)) KOUNT(KMAX)
      IF (ITRAP.EQ.0) GO TO 370
C    EXTRA COLUMN FOR TRAP SAMPLES
      ENCODE(6,361,A(9)) KOUNT(KMAX)
      A(10)=A(8)
  370 PRINT 371,A
  371 FORMAT (10A10)
      RETURN
      END
C
C**********************
C
      SUBROUTINE CODE(X,Y)
C    SUBROUTINE TO CONVERT FROM NUMERIC TO ALPHABETIC FORMAT
   10 IF (X.EQ.0.) GO TO 50
      IF (X.LT.0.) GO TO 90
      IF (X.LT..99) GO TO 70
      ENCODE(10,11,Y) X
   11 FORMAT (F10.0)
      RETURN
C    ZERO VALUES ARE LEFT BLANK
   50 Y=1H
      RETURN
C    VALUES LESS THAN .99 ARE PRINTED TO NEAREST TENTH
   70 ENCODE(10,71,Y) X
   71 FORMAT (F10.1)
      RETURN
C    NEGATIVE VALUES ARE CODED AS SCAN
   90 Y=10H       SCAN
      RETURN
      END
C
C**********************
C
      FUNCTION PERCENT(X,N)
C    FUNCTION TO CALCULATE PERCENTAGE
C    CALLS SUBROUTINE CODE
C    VALUE RETURNED IS ALPHABETIC
      IF (X.EQ.10H       SCAN) GO TO 100
      IF (X.LT.0.) GO TO 90
      XN=N
      X=X/XN*100.
   90 CALL CODE(X,PERCENT)
      RETURN
  100 PERCENT = 1H
      RETURN
      END
```

3.0 PRPLOT

The PRPLOT Program uses the numerical data to form a histogram display which can be generated at low cost as the pollen counting proceeds. An immediate assessment of the diagram as analysis proceeds is therefore possible. Areas of special interest for closer sampling and anomalies are identified. The histogram display is vital to the preparation of the finished publishable diagram, because it aids the selection of appropriate scale sizes and scale changes. This PRPLOT "working diagram" can also be used for "preprint" distribution of large diagrams which would be impracticable to reproduce by other means.

This histogram display is a line printer output, not CALCOMP or microfilm, the cost is therefore low. An added advantage of printer output is that it can be produced much more quickly than either CALCOMP or microfilm.

3.1 Appearance of the Diagram

The diagram is organized with the width of the paper as the vertical axis (depth of profile or list of samples) and the length of the paper as the horizontal axis, extending over as many pages as necessary. Thus a 90-degree rotation counterclockwise brings it into the same orientation as a publishable diagram. Further references to top and bottom, and right and left, will be in the orientation of the published diagram, with printed lines running vertically up the diagram (see Figure 3.1).

The title (site description) appears along the left-most end of the page, followed by the data type (absolute or relative) near the top of the page. The scale is noted at the top of the page before the first taxon name; the scale also appears whenever a taxon requires a different

scale from the preceding taxon.

Each taxon is labeled with a complete name (instead of the three-letter abbreviations used for POLDATA). Immediately to the right of the taxon name are the vertical axis markers. Gaps in depth samples are not recognized; each sample is listed in order from top to bottom, including duplicate levels and dummy samples (cf. Figures 3.1 and 3.2). Depth samples are marked with a plus sign at 10-cm intervals (every fourth level for a standard sampling interval of 2.5 cm); for all others, every tenth sample is marked (Figure 3.3). For "absolute" data a scale factor may appear above the axis markers.

Up to 120 samples may appear on one page. If the diagram is larger than this, it will be broken into as many sections as required, each section containing histograms up to 120 deep for all the taxa.

On the histogram itself, a scan-only observation is indicated by a single plus sign (+) and the value for each sample or level is indicated by a bar of asterisks. The horizontal axis is labeled every ten asterisks.

A maximum of 165 asterisks are printed for any sample; the actual values for any bars that reach this maximum are listed, in order, to the right of the bars and beginning at the bottom of the diagram. Thus, if six samples (not necessarily adjacent) required 165 asterisks, six values are printed, with the right-most value associated with the right-most bar of length 165 (Figure 3.4).

3.2 Card Setup

Some of the cards required by the PRPLOT program are included in the POLDATA punched card output; these will be noted in the following descriptions.

3.2.1 *Option Card*

The first card, if present, specifies a profile; the word DEPTH punched in the first five columns of the card will cause the depth option to be selected. If the DEPTH card is not present, a set of single samples is assumed. Although this option is the same as one of those for POLDATA, this card is not included in the POLDATA card output.

3.2.2 *Title Card*

A title card identifies the site location for the samples. This is the same as the title card for POLDATA without the information concerning exclusions; a suitable title card is included in the POLDATA card output.

3.2.3 *Number of Taxa*

The number of taxa is specified in the next card in columns two and three. This card is also provided in the card output from POLDATA.

3.2.4 *Taxon Names*

Taxon names must be specified in a more complete form than for POLDATA. Instead of a three-letter code, each name is written out on a separate card, with the cards in the same sequence as the taxa in the data deck. Every position in the data cards must have a corresponding name card. If the user wishes to eliminate one or more taxa from the diagram, a card containing only a minus sign in column one is used in place of the corresponding name card for each taxon to be skipped.

3.2.5 *Data Type*

The next card specifies the data type, beginning in column one; "absolute" and relative are the only types currently recognized by the program.

The type must be specified because the next three cards are required for "absolute" data only and must not be included for relative data.

3.2.6 *"Exotics" Summary*

Sometimes a summation of specified taxa is included in the publishable diagram with the label "exotics." PRPLOT anticipates this by allowing the user to see the magnitude of this sum. The next card in the setup provides for the selection of these taxa. Each column of the card corresponds to a taxon, in the same order as the name cards, with a one in that column indicating selection for the summary and a zero indicating that the taxon is not to be included. A card with only zero values (or a blank card) will instruct the program to ignore the summary. One card only is needed unless the number of taxa is greater than 80; in this case two cards are required even if the second card is left blank.

3.2.7 *Group Divisions*

"Absolute" data can be extremely variable in magnitude; thus some flexibility in scaling is needed. It is assumed that the three initial groupings of taxa (trees and shrubs, herbs, and spores) are relatively homogenous with respect to pollen counts, and that the histograms for all the taxa in a group are reasonably represented by using the same scale factor for each of them. The punched output from POLDATA, therefore, includes a card with the sequence number of the last taxon in each group punched in three-column fields, to be used as input to PRPLOT and/or DISPLAY. Any division may be specified, however, in order to divide the taxa into up to three relatively homogenous groups. The divisions are indicated by punching the sequence number of the last taxon in the group in the appropriate field (columns 2-3 for group one, 5-6 for group two, and 8-9 for group three).

3.2.8 *Scale Card*

A second card in the same format selects the scale factor for each group. The value represented by a single asterisk is 20×10^n, where n is the scale number (i.e., 200, 2000, and 20,000 for scales 1, 2, and 3, respectively). It was not anticipated that a scale factor greater than 1 to 20,000 would be necessary.

3.2.9 *Data Cards*

The data deck as supplied by POLDATA (and sorted into absolute or relative only) is the final set of cards needed to produce a PRPLOT histogram. A blank card indicates the end of the data.

3.2.10 *Multiple Diagrams*

To produce diagrams for more than one data type at the same site (i.e., both relative and absolute) the option card (if any), title card, number of taxa, and name cards need not be repeated.

Other sites may be processed in the same setup by including an additional blank card and then beginning the sequence again with a new option card (if needed), title card, etc.

Figure 3.5 shows examples of card setups for various situations.

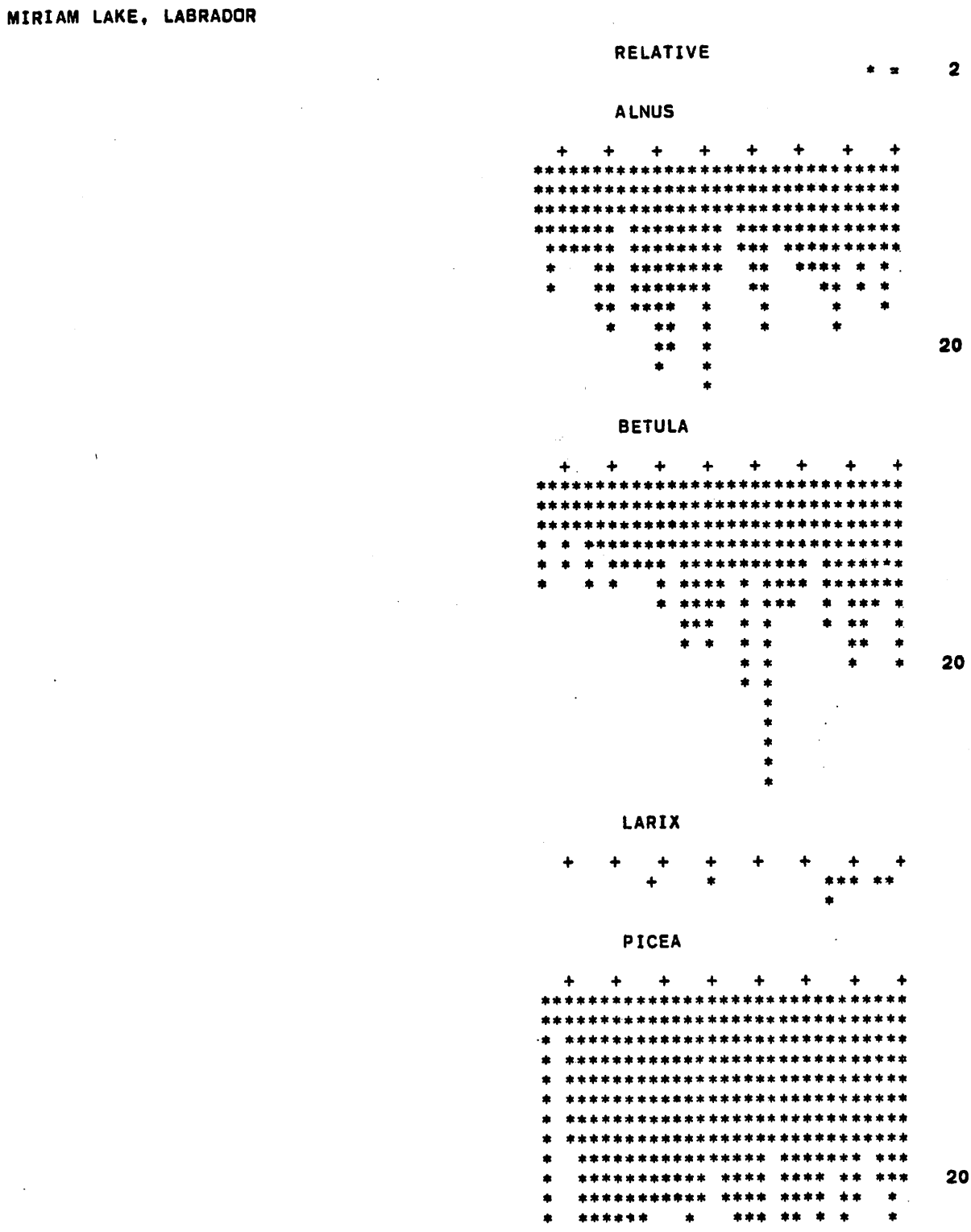


Figure 3.1. Typical printed output from PRPLOT for a profile diagram (relative data).

WINDY LAKE, BAFFIN ISLAND

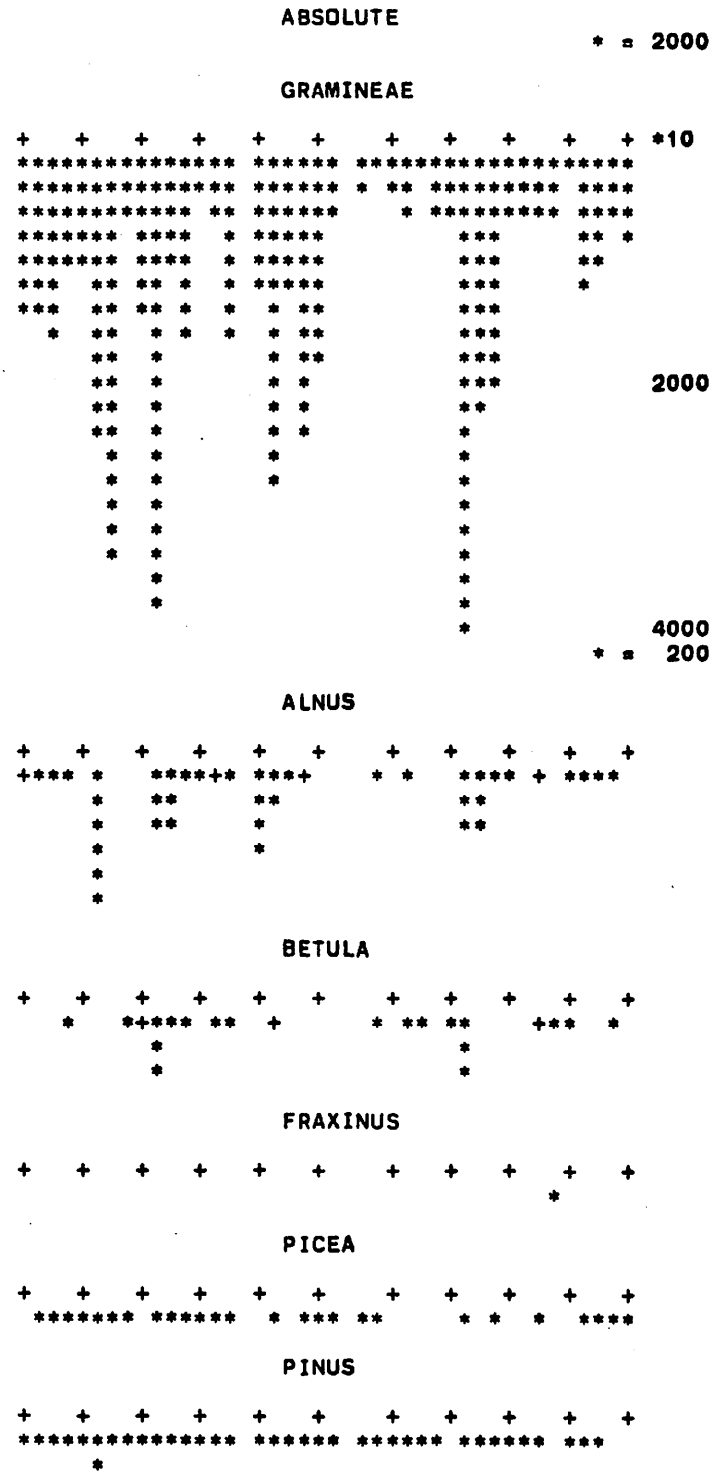


Figure 3.2. Printed output from PRPLOT for a profile diagram with slightly irregular levels (absolute data).

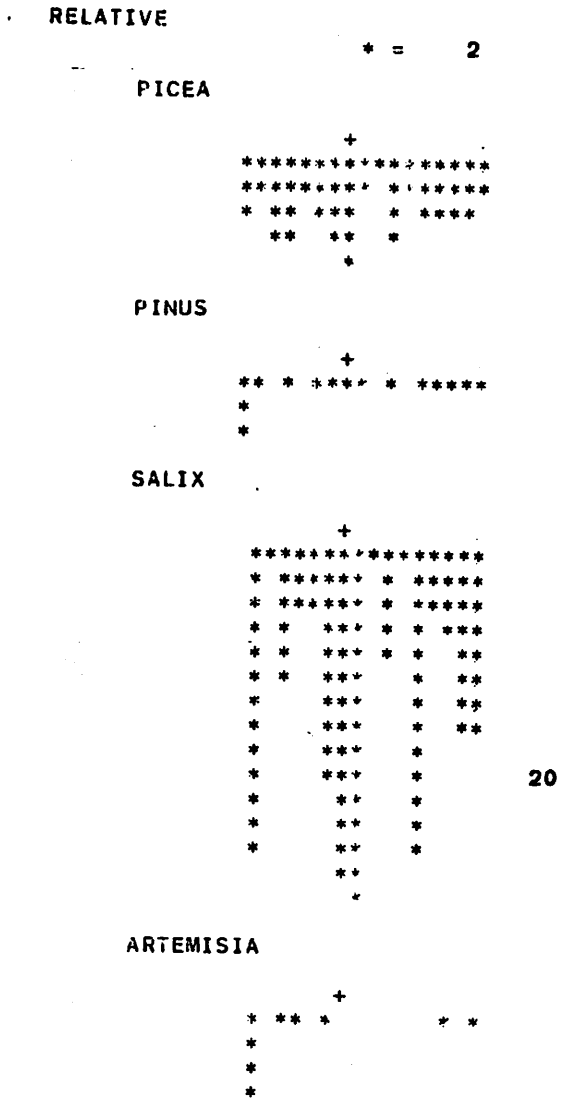


Figure 3.3. Printed output from PRPLOT for a set of single fossil samples (relative data).

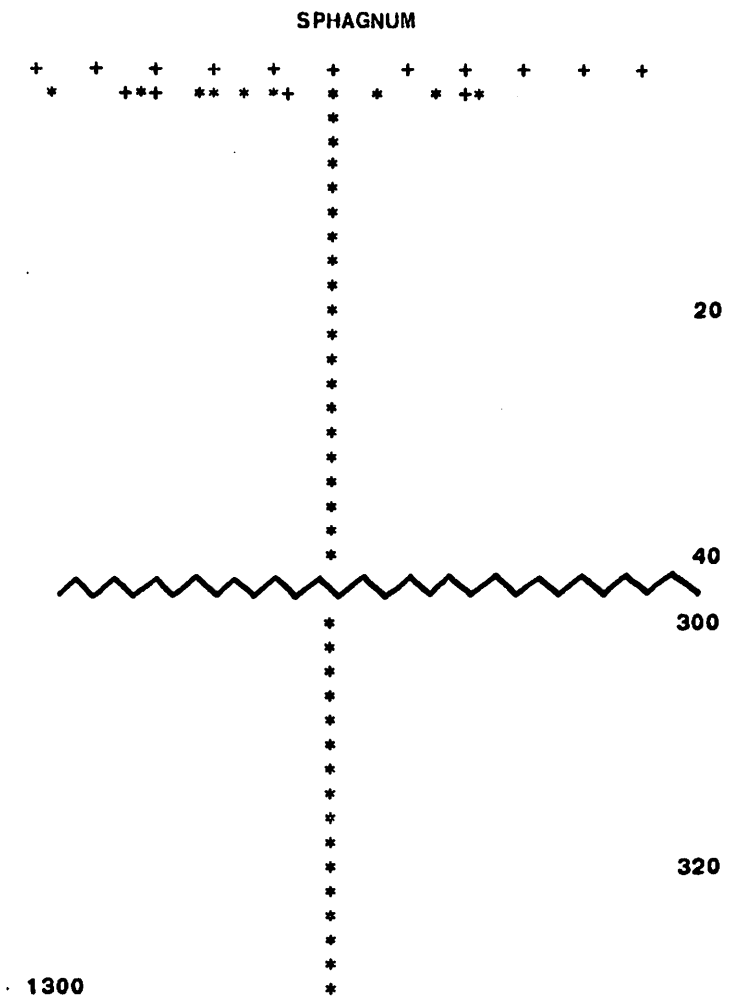


Figure 3.4. Printed output from PRPLOT showing truncation.

```
CARD COLUMN:
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

DEPTH
WINDY LAKE, BAFFIN ISLAND
 25
SALIX
GRAMINEAE
ALNUS
BETULA
FRAXINUS
PICEA
PINUS
ULMUS
ARTEMISIA
CARYOPHYLLACEAE
CHENOPODIINEAE
COMPOSITAE
CRUCIFERAE
EPILOBIUM
MYRICA
POTENTILLA
RANUNCULACEAE
ROSACEAE
RUBUS
TYPHA
SAXIFRAGACEAE
CYPERACEAE
ERICACEAE
FILICALES
SPHAGNUM
ABSOLUTE

  2 25
  2  1
WNDLA   0A1001     263    6177                              16
WNDLA   0A1002                      131
WNDLA   0A1003                                            66      131
WNDLA   0A1004
WNDLA  25A1001     586    4004       49       98          12
WNDLA  25A1002            49                              98
WNDLA  25A1003                                           146       49
WNDLA  25A1004
WNDLA  50A1001     986    8286       99                    8       73
WNDLA  50A1002            395
WNDLA  50A1003                                           296
WNDLA  50A1004

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

a. For a profile, absolute data (beginning only).

Figure 3.5. Samples of card setups.

```
CARD COLUMN:
        1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

ROSE ISLAND, LABRADOR
 21
ALNUS
BETULA
PICEA
PINUS
SALIX
ARTEMISIA
CARYOPHYLLACEAE
CHENOPOD
COMPOSITAE-LIGULIFLORAE
COMPOSITAE-TUBULIFLORAE
EPILOBIUM
GRAMINEAE
MYRICA
POLYGONUM
ROSACEAE
CYPERACEAE
ERICACEAE
FILICALES
LYCOPODIUM CLAVATUM
LYCOPODIUM SELAGO
SPHAGNUM
RELATIVE
ROSEI1-2 R3001   5  50   3  .3  15  .3   3              .3  23  .3      .7  10
ROSEI1-2 R3002  37                .3
ROSEI2   R3001  10  55   6  .7  16       2                  11                10
ROSEI2   R3002  46                .3
ROSEI2-3 R3001   7  58   6  .3   8   1  .3          .7      18  .3       1  18
ROSEI2-3 R3002  51                .3

        1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

b. For a set of single fossil samples, relative data (beginning only).

Program Listing for PRPLOT

```
C     PRPLOT
C
C    PROGRAM TO DRAW HISTOGRAMS ON PRINTER OUTPUT
C
C    DEVELOPED IN 1975 BY MARGARET M. ECCLES
C    UNDER THE DIRECTION OF MARGARET HICKEY
C
C    CARD SET-UP
C
C      1) OPTION CARD:  DEPTH IN COLS. 1 - 5 FOR PROFILE SAMPLES ONLY
C      2) TITLE CARD:  80 COLUMNS, SITE DESCRIPTION
C      3) NUMBER OF TAXA : COLUMNS 2-3
C      4) TAXON NAMES:  20 COLUMNS, ONE NAME PER CARD
C      5) DATA TYPE:  COLUMN ONE MUST CONTAIN FIRST LETTER
C      6) EXOTICS SUMMARY: (ABSOLUTE ONLY)
C         1 INDICATES TAXON IS TO BE INCLUDED IN SUMMARY, 0 OR BLANK
C           INDICATES TAXON IS NOT INCLUDED.
C         COL. 1  FLAG FOR FIRST TAXON
C         COL. 2  FLAG FOR SECOND TAXON
C           ...   ...
C           ETC. FOR AS MANY TAXA AS SPECIFIED IN 3).  IF MORE THAN 80,
C           CONTINUE ON SECOND CARD
C      7) SPLIT POINTS: (ABSOLUTE ONLY)
C         COL. 2-3  NUMBER OF LAST TAXON IN FIRST GROUP
C         COL. 5-6  NUMBER OF LAST TAXON IN SECOND GROUP
C         COL. 8-9  NUMBER OF LAST TAXON IN THIRD GROUP
C      8) SCALES: (ABSOLUTE ONLY)
C         COL. 3  SCALE FOR FIRST GROUP
C         COL. 6  SCALE FOR SECOND GROUP
C         COL. 9  SCALE FOR THIRD GROUP
C         SCALES ARE:  1  *=200
C                      2  *=2000
C                      3  *=20000
C      9) DATA CARDS:
C        COLS. 1- 5  SITE IDENTIFICATION
C        COLS. 6- 9  SAMPLE OR LEVEL DESIGNATION
C        COL.    10  DATA TYPE
C        COLS.11-13  IGNORED
C        COL.    14  CARD NUMBER
C        COLS.15-78  DATA FIELDS - 16 FOUR-COLUMN FIELDS FOR RELATIVE
C                                  OR 8 EIGHT-COLUMN FIELDS FOR ABSOLUTE
C
      PROGRAM PRPLOT(INPUT,OUTPUT,TAPE5=INPUT,TAPE1=OUTPUT)
      COMMON C(300,97)
      DIMENSION DEPTH(300),LABEL(8,97),TITLE(8),ISUM(97),A(120),TYPE(2),
     .OFLOW(15),SCALE(2,3),IGSCALE(3),TIMES(3),IGR(3),NV(2),FMT(3),F(2)
      DATA SCALE/200.,2.,2000.,2.,20000.,2./,TIMES/1H ,4H *10,5H *100/
      DATA BLANK/1H /,AST/1H*/,SCAN/1H+/,TYPE/8HABSOLUTE,8HRELATIVE/
      DATA FMT/10H(A5,A4,R1,, 6H3X,I1,, 1H  /,F/6H8F8.0), 7H16F4.0)/
      DATA IDEPTH/0/,MM/120/,NV/8,16/
C
C         READ TITLE CARD
      READ 11,TITLE
C    CHECK FOR DEPTH OPTION
      IF(TITLE.NE.5HDEPTH) GO TO 20
      IDEPTH=1
   10 READ 11,TITLE
   11 FORMAT (8A10)
      IF (EOF,5) 900,20
   20 PRINT 71
      PRINT 21,TITLE
   21 FORMAT (1H0,12A10)
```

```
C    READ NUMBER OF TAXA
       READ 22,NTAXA
    22 FORMAT (16I3)
C    READ TAXON NAMES
       READ  11,((LABEL(I,J),I=1,8),J=1,NTAXA)
         PRINT 21,((LABEL(I,J),I=1,3),J=1,NTAXA)
C    CREATE NAME FOR EXOTICS SUMMARY
       NT=NTAXA+1
       LABEL(1,NT)=7HEXOTICS
       LABEL(2,NT)=1H
C         READ DATA TYPE
       READ 26,ITYPE
    26 FORMAT (R1)
    50 CONTINUE
       ITY=ITYPE
       IF (ITY.EQ.1) GO TO 60
       IF (ITY.NE.18) GO TO 980
       ITY=2
       GO TO 70
    60 CONTINUE
C         READ TAXA TO BE SUMMED FOR EXOTICS(ABSOLUTE ONLY)
       READ 61,(ISUM(I),I=1,NTAXA)
    61 FORMAT (80I1)
       PRINT 21
       PRINT 22,(ISUM(I),I=1,NTAXA)
       ISUM(NT)=0
C         READ SPLIT POINTS(ABSOLUTE ONLY)
       READ 22,IGR
       PRINT 21
       PRINT 22,IGR
C         READ SCALES(ABSOLUTE ONLY)
       READ 22,IGSCALE
       PRINT 21
       PRINT 22,IGSCALE
    70 CONTINUE
       NVAL=NV(ITY)
       FMT(3)=F(ITY)
       PRINT 71,TITLE
    71 FORMAT (1H1,45X,8A10)
       PRINT 207,TYPE(ITY)
       IF (ITY.EQ.2) PRINT 203,SCALE(ITY,1)
C           READ DATA CARDS
       L=0
   100 L=L+1
       J=1
   110 K=MIN0(J+NVAL-1,NTAXA)
       READ FMT,NAME,DEPTH(L),IA,IC,(C(L,I),I=J,K)
C    CHECK FOR END OF SITE
       IF(IC.EQ.0) GO TO 180
C    IGNORE DUMMY LEVELS OR SAMPLES
       IF(NAME.EQ.5HDUMMY.OR.DEPTH(L).EQ.1H ) GO TO 150
       IF (L.NE.1) GO TO 120
       LOC=NAME
       GO TO 130
C    CHECK SITE IDENTIFICATION
   120 IF (LOC.NE.NAME) GO TO 920
   130 CONTINUE
       IF(IDEPTH.EQ.0) GO TO 140
C    DEPTH SAMPLES - CHANGE LEVEL DESIGNATION TO NUMERIC
       DECODE(4,131,DEPTH(L)) DEPTH(L)
   131 FORMAT (F4.1)
       GO TO 150
C    NON-DEPTH SAMPLES - ASSIGN SEQUENCE NUMBER AS LEVEL DESIGNATION
   140 CONTINUE
       DEPTH(L)=L
   150 CONTINUE
C    CHECK SEQUENCE
       IF (IC.NE.J/NVAL+1) GO TO 940
C    CHECK DATA TYPE
       IF (IA.NE.ITYPE) GO TO 930
```

```
C    CHECK FOR TOO MANY LEVELS
       IF (L.GT.300) GO TO 950
C    GET READY TO READ NEXT CARD
       J=J+NVAL
       IF (K.EQ.NTAXA)100,110
C    END OF DATA CARDS
  180  L=L-1
       DO 190 I=1,L
  190  C(I,NT)=0.
       ASCALE=SCALE(ITY)
       JJ=1
C         LOOP OVER PAGES (120 LEVELS PER PAGE)
       DO 300 II=1,L,MM
       IJ=MIN0(II+MM-1,L)
C         LOOP FOR EACH TAXON
       LSC=0
       IG=1
       IS=0
       DO 290 J=1,NT
C          SKIP TAXA WITH NAME - (MINUS SIGN IN COLUMN 1)
       IF(LABEL(1,J).EQ.1H-)GO TO 290
       IF (J.LT.NT) GO TO 200
C    CHECK FOR EXOTICS SUMMARY
       IF (IS.EQ.0) GO TO 290
       I=IGSCALE(1)
       GO TO 202
  200  CONTINUE
       IF (ITY.EQ.2) GO TO 205
C          CHECK SCALE FOR ABSOLUTE DATA
       IF (J.GT.IGR(IG)) IG=IG+1
       I=IGSCALE(IG)
  202  CONTINUE
       IF (I.EQ.LSC) GO TO 205
       PRINT 203,SCALE(ITY,I)
  203  FORMAT (117X,4H * =,F5)
       LSC=I
       ASCALE=SCALE(ITY,I)
       JJ=I
  205  CONTINUE
C    PRINT TAXON NAME
       PRINT 207,(LABEL(I,J),I=1,3)
  207  FORMAT (1H0,96X,3A10/)
C    ACCUMULATE FOR NUMBER OF TAXA IN EXOTICS SUMMARY
       IS=IS+ISUM(J)
       M=MM
       DO 210 I=II,IJ
C    ACCUMULATE POLLEN COUNTS FOR EXOTICS SUMMARY
       IF (ISUM(J).GT.0) C(I,NT)=C(I,NT)+C(I,J)
C    SET LEVEL POINTERS
       A(M)=BLANK
       IF (AMOD(DEPTH(I),10.).EQ.0.) A(M)=1H+
  210  M=M-1
       IF (M.EQ.0) GO TO 230
C      BLANK BEGINNING OF LINE
       DO 220 I=1,M
  220  A(M)=BLANK
C    PRINT LEVEL POINTERS
  230  WRITE (1,231) A,TIMES(JJ)
  231  FORMAT (X,120A1,A5)
C         LOOP FOR LENGTH OF BAR
       VAL=VALABEL=0.
       M=MM
C    CHECK FOR SCANS AND PRINT FIRST COLUMN OF ASTERISKS
       DO 240 I=II,IJ
       A(M)=AST
       IF (C(I,J).LT.0.) A(M)=SCAN
       IF (C(I,J).EQ.0.) A(M)=BLANK
       M=M-1
  240  CONTINUE
       PRINT 231,A
```

```
      VAL =ASCALE
      VALABEL=SCALE(ITY)
C     LOOP OVER REST OF BAR
      DO 270 K=2,165
      M=MM
      IFF=0
      DO 260 I=II,IJ
      IF (C(I,J).LE.VAL) GO TO 250
      A(M)=AST
      IFF=1
      GO TO 260
  250 A(M)=BLANK
  260 M=M-1
      IF (IFF.EQ.0) GO TO 290
      VAL=VAL+ASCALE
      VALABEL=VALABEL+SCALE(ITY)
      PRINT 231,A
      IF (MOD(K,10).NE.0) GO TO 270
C     LABEL BAR AT EVERY TENTH ASTERISK
      PRINT 261,VALABEL
  261 FORMAT (1H+,120X,F5.0)
  270 CONTINUE
      IFF=0
      M=M+1
      I=IJ
C     CHECK FOR BARS 165 ASTERISKS LONG
      DO 280 K=M,MM
      IF (A(K).EQ.BLANK) GO TO 280
      IFF=IFF+1
      OFLOW(IFF)=C(I,J)
      IF (IFF.LT.15) GO TO 280
      PRINT 277,OFLOW
  277 FORMAT (1X,15F9.0)
      IFF=0
  280 I=I-1
      IF (IFF.NE.0) PRINT 277, (OFLOW(I),I=1,IFF)
  290 CONTINUE
C     END OF LOOP OVER TAXA
C     BEGIN NEW PAGE
      PRINT 21,N1
  300 CONTINUE
C     CHECK FOR LAST CARD
      READ 26,ITYPE
      IF (EOF,5) 900,310
  310 IF (ITYPE.EQ.1) GO TO 50
      IF (ITYPE.EQ.18) 50,10
C     END OF RUN
  900 CONTINUE
      STOP
C     ERROR MESSAGES
  920 PRINT 921,LOC,NAME,DEPTH(L),IC
  921 FORMAT (1H1,A5,* EXPECTED,*,A5,* FOUND*,F6.1,I3)
      STOP
  930 PRINT 931,IA,ITYPE
  931 FORMAT (1H1,R1,* FOUND AMONG *,R1)
      STOP
  940 I=J/NVAL+1
      PRINT 941,IC,I
  941 FORMAT (*1CARD*,I2,* FOUND WHERE CARD*,I2,* EXPECTED*)
      GO TO 110
  950 PRINT 951
  951 FORMAT (*1TOO MANY LEVELS*)
      STOP
  980 PRINT 981,ITY
  981 FORMAT (*1ILLEGAL TYPE (RELATIVE OR ABSOLUTE) - *,R1)
      STOP
      END
```

4.0 GROFORM

The program GROFORM was designed as a supplement to POLDATA in order to obtain diagrams of groups of taxa in the same style as the diagrams for individual taxa. GROFORM uses the cards produced by POLDATA as input, organizes the taxa into certain groups, and prints and punches summary values as well as certain measures of diversity. The card output can be used by the DISPLAY program.

Two different groupings were selected by this laboratory and have been incorporated into the program; these are called Growth Form and Ecology (see Section 1.8). There are six Growth Form groups--trees, shrubs, herbs, graminoids, mosses, and ferns--and four Ecology groups--exotics, xeric, mesic, and hydric. The program assumes that each taxon will fall into one Growth Form group and one Ecology group.

4.1 Calculations

For each group the program calculates the total count for the group and the percentage of all grains for the sample. Two measures of diversity (Simpson's and Shannon's; Ager, 1963) are calculated for the Growth Form groups, but only Shannon's Diversity is calculated for the Ecology group.

Simpson's Diversity is represented by the formula $N(N-1)/\Sigma\{n(n-1)\}$ summed over all groups, where N is the total number of pollen grains for the sample and n is the number of pollen grains for each life form.

Shannon's Diversity is represented by the formula $-\Sigma\ P(\ln P)$ summed over all groups where P is the ratio n/N and ln is the natural (base e) log.

4.2 Printed Output

For each sample, the program prints two lines. At the beginning of the top line are, from left to right, the sample identification, the number of taxa represented in the sample, and the total count for the sample. Next are the six counts for each of the Growth Form groups, followed by the Simpson's and Shannon's diversities. To the right of that are the four counts for the Ecology groups, followed by Shannon's Diversity. The second line contains the percentage for each group immediately under the total count for each, for both the Growth Form and Ecology groups (see Figure 4.1).

4.3 Card Output

Card output for Growth Form data requires two cards. The format is as follows (see Figure 4.2):

Data Field (Card Columns)	Contents of Field
Card 1	
1-5	Site identification
6-9	Sample identification
10	Data type (L)
11-13	Count total from which absolute values were calculated
14	Card number (1)
15-17	Total number of taxa represented in the sample
18-28	Total pollen count for sample
29-36	Total pollen count for trees
37-44	Total pollen count for shrubs
45-52	Total pollen count for herbs
53-60	Total pollen count for graminoids
61-68	Total pollen count for mosses
69-76	Total pollen count for ferns
Card 2	
1-13	Same as for card 1
14	Card number (2)

Data Field (Card Columns)	Contents of Field
Card 2 (cont.)	
15-18	Percentage for trees
19-22	Percentage for shrubs
23-26	Percentage for herbs
27-30	Percentage for graminoids
31-34	Percentage for mosses
35-38	Percentage for ferns
39-40	Blank
41-45	Simpson's Diversity
46-50	Shannon's Diversity

Card output for Ecology data fits on one card. The format is as follows (see Figure 4.2):

Data Field (Card Columns)	Contents of Field
1-5	Site identification
6-9	Sample identification
10	Data type (E)
11-13	Count total from which absolute values were calculated
14	Card number (1)
15-22	Total pollen count for exotics
23-30	Total pollen count for xeric
31-38	Total pollen count for mesic
39-46	Total pollen count for hydric
47-50	Percentage for exotics
51-54	Percentage for xeric
55-58	Percentage for mesic
59-62	Percentage for hydric
63-65	Blank
66-70	Shannon's Diversity

4.4 Card Setup

GROFORM is a far less elaborate program than POLDATA or DISPLAY, and the card setup is much simpler (see Figure 4.3).

The first card simply specifies the number of taxa in columns 2 and 3.

The second card indicates the Growth Form group for each taxon. A value from 1 to 6 specifies the group number. The number for the first taxon is punched in column 1, for the second in column 2, and so forth for as many taxa as indicated by the value in the first card.

The third card indicates the Ecology group for each taxon in the same manner. The only difference is that the values are in the range 1 to 4 instead of 1 to 6.

The next cards are the data cards for each sample. The program expects only "absolute" values and will terminate if any other type of data is found. The format of these cards is as follows:

Data Field (Card Columns)	Contents of Field
1-5	Site identification
6-9	Sample identification
10	Data type code (A)
11-13	Count total from which absolute values were calculated
14	Card number
15-22	Value for first taxon
23-30	Value for second taxon
...	...
etc.	for up to eight taxa.

For more than eight taxa, additional cards are used.

More than one site may be processed by following data cards with a blank card and repeating the entire sequence.

LOC	TAXA	TOTAL	TREES	SHRUBS	HERBS	GRAM	MOSSES	FERNS	SIMP	SHAN	EXOTICS	XERIC	MESIC	HYDRIC	SHAN
0	17	172607	43898	63076	2983	41767	2983	17900	3.730	1.435	852	20457	108679	42619	.916
			25.4	36.5	1.7	24.2	1.7	10.4			.5	11.9	63.0	24.7	
50	13	176798	47058	62011	2199	45299	0	20231	3.666	1.371	440	22430	111268	42660	.911
			26.6	35.1	1.2	25.6	0.0	11.4			.2	12.7	62.9	24.1	
100	17	130811	53280	42256	4409	20945	1102	8819	3.315	1.360	1837	10656	98843	19475	.759
			40.7	32.3	3.4	16.0	.8	6.7			1.4	8.1	75.6	14.9	
150	15	125137	52634	39388	2092	20565	1743	8715	3.243	1.338	3486	10109	92022	19520	.819
			42.1	31.5	1.7	16.4	1.4	7.0			2.8	8.1	73.5	15.6	
200	15	146997	74115	36647	1647	25117	0	9471	2.859	1.220	3294	10295	110762	22646	.773
			50.4	24.9	1.1	17.1	0.0	6.4			2.2	7.0	75.3	15.4	
250	14	385885	215572	125055	5955	27393	1191	10719	2.363	1.060	4764	14292	341818	25011	.461
			55.9	32.4	1.5	7.1	.3	2.8			1.2	3.7	88.6	6.5	
300	14	212948	114420	64203	2543	21612	1271	8899	2.552	1.144	1271	9535	180530	21612	.542
			53.7	30.1	1.2	10.1	.6	4.2			.6	4.5	84.8	10.1	
350	16	154981	65568	57316	3211	19716	917	8253	2.983	1.261	917	10547	126552	16965	.621
			42.3	37.0	2.1	12.7	.6	5.3			.6	6.8	81.7	10.9	
400	16	188465	80608	74364	3406	19361	568	10213	2.838	1.212	568	15327	157810	14760	.570
			42.8	39.5	1.8	10.2	.3	5.4			.3	8.1	83.7	7.8	
450	17	237834	138049	73526	6753	12004	2251	5251	2.291	1.059	3751	8253	214576	11254	.419
			58.0	30.9	2.8	5.0	.9	2.2			1.6	3.5	90.2	4.7	
500	13	253837	120197	100427	791	15816	2372	14234	2.578	1.117	4745	13443	218252	17397	.544
			47.4	39.6	.3	6.2	.9	5.6			1.9	5.3	86.0	6.9	
550	14	221621	89069	98187	2104	16131	0	16130	2.714	1.153	701	18234	192867	9819	.483
			40.2	44.3	.9	7.3	0.0	7.3			.3	8.2	87.0	4.4	
600	14	229832	74659	120771	2196	13907	0	18299	2.553	1.119	1464	19763	199822	8783	.490
			32.5	52.5	1.0	6.1	0.0	8.0			.6	8.6	86.9	3.8	
650	14	302476	39728	206767	4515	28894	903	21669	2.004	1.020	1806	27086	247399	26185	.623
			13.1	68.4	1.5	9.6	.3	7.2			.6	9.0	81.8	8.7	
700	14	335271	38887	243834	3153	23132	0	26275	1.807	.909	2102	32581	286925	13663	.522
			11.6	72.7	.9	6.9	0.0	7.8			.6	9.7	85.6	4.1	
750	16	515828	44716	380083	4791	38328	1597	46313	1.773	.908	6388	55895	424709	28746	.616
			8.7	73.7	.9	7.4	.3	9.0			1.2	10.8	82.4	5.6	
800	15	329985	25305	241923	3036	31379	1012	27330	1.788	.915	1012	31379	274313	23281	.582
			7.7	73.3	.9	9.5	.3	8.3			.3	9.5	83.1	7.1	
850	14	408434	52270	285661	3647	41329	0	25527	1.924	.960	3647	32820	335500	36467	.622
			12.8	69.9	.9	10.1	0.0	6.2			.9	8.0	82.1	8.9	
900	14	362737	20597	274628	2288	19453	1144	44627	1.682	.838	0	49204	297513	16020	.571
			5.7	75.7	.6	5.4	.3	12.3			0.0	13.6	82.0	4.4	
950	14	421124	28075	321587	1276	34435	0	35731	1.663	.818	1276	44664	344557	30627	.610
			6.7	76.4	.3	8.2	0.0	8.5			.3	10.6	81.8	7.3	
1000	11	386059	19486	308116	0	23179	1218	34100	1.536	.732	0	38971	331256	15832	.494
			5.0	79.8	0.0	6.0	.3	8.8			0.0	10.1	85.8	4.1	
1050	11	261264	9009	208029	0	17199	0	27027	1.538	.711	819	31122	217857	11466	.560
			3.4	79.6	0.0	6.6	0.0	10.3			.3	11.9	83.4	4.4	
1100	12	570844	16258	467876	3612	36130	0	46968	1.463	.677	3613	48774	489553	28904	.525
			2.8	82.0	.6	6.3	0.0	8.2			.6	8.5	85.8	5.1	

Figure 4.1. Typical printed output from GROFORM.

```
CARD COLUMN:
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890


UBLIK   0L3001 17     172607   43898   63076    2983   41767    2983   17900
UBLIK   0L3002 254 365  17 242  17 1043.7301.435
UBLIK   0E3001 17     172607     852   20457  108679   42619   5 119 630 247 .91
UBLIK  50L3001 13     176798   47058   62011    2199   45299       0   20231
UBLIK  50L3002 266 351  12 256   0 1143.6661.371
UBLIK  50E3001 13     176798     440   22430  111268   42660   2 127 629 241 .91
UBLIK 100L3001 17     130811   53280   42256    4409   20945    1102    8819
UBLIK 100L3002 407 323  34 160   8  673.3151.360
UBLIK 100E3001 17     130811    1837   10656   98843   19475  14  81 756 149 .75
UBLIK 150L3001 15     125137   52634   39388    2092   20565    1743    8715
UBLIK 150L3002 421 315  17 164  14  703.2431.338
UBLIK 150E3001 15     125137    3486   10109   92022   19520  28  81 735 156 .81
UBLIK 200L3001 15     146997   74115   36647    1647   25117       0    9471
UBLIK 200L3002 504 249  11 171   0  642.8591.220
UBLIK 200E3001 15     146997    3294   10295  110762   22646  22  70 753 154 .77
UBLIK 250L3001 14     385885  215572  125055    5955   27393    1191   10719
UBLIK 250L3002 559 324  15  71   3  282.3631.060
UBLIK 250E3001 14     385885    4764   14292  341818   25011  12  37 886  65 .46


         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

a. Before sorting.

```
CARD COLUMN:
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890


UBLIK   0E3001 17     172607     852   20457  108679   42619   5 119 630 247 .91
UBLIK  50E3001 13     176798     440   22430  111268   42660   2 127 629 241 .91
UBLIK 100E3001 17     130811    1837   10656   98843   19475  14  81 756 149 .75
UBLIK 150E3001 15     125137    3486   10109   92022   19520  28  81 735 156 .81
UBLIK 200E3001 15     146997    3294   10295  110762   22646  22  70 753 154 .77
UBLIK 250E3001 14     385885    4764   14292  341818   25011  12  37 886  65 .46
UBLIK   0L3001 17     172607   43898   63076    2983   41767    2983   17900
UBLIK   0L3002 254 365  17 242  17 1043.7301.435
UBLIK  50L3001 13     176798   47058   62011    2199   45299       0   20231
UBLIK  50L3002 266 351  12 256   0 1143.6661.371
UBLIK 100L3001 17     130811   53280   42256    4409   20945    1102    8819
UBLIK 100L3002 407 323  34 160   8  673.3151.360
UBLIK 150L3001 15     125137   52634   39388    2092   20565    1743    8715
UBLIK 150L3002 421 315  17 164  14  703.2431.338
UBLIK 200L3001 15     146997   74115   36647    1647   25117       0    9471
UBLIK 200L3002 504 249  11 171   0  642.8591.220
UBLIK 250L3001 14     385885  215572  125055    5955   27393    1191   10719
UBLIK 250L3002 559 324  15  71   3  282.3631.060


         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

b. After sorting.

Figure 4.2. Card output from GROFORM (first six samples only).

```
CARD COLUMN:
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890


 27
22111213333333432334626666 5
33331311223332323334222244 4
UBLIK    0A3001    23014    30686     2131    41341      426     4688              426
UBLIK    0A3002      426                                2131             2557
UBLIK    0A3003     2131                          39210             2557     3410    14064
UBLIK    0A3004                426     2983
UBLIK   50A3001    25508    30786     2639    43979      440     1319
UBLIK   50A3002                                          2199             2639
UBLIK   50A3003     2199                          42660             2199     6597    13634
UBLIK   50A3004
UBLIK  100A3001    18005    21312      367    51443     1470     1470              367
UBLIK  100A3002      735                                3307             2572
UBLIK  100A3003      367                          18373             1102     2940     5512
UBLIK  100A3004      367                1102
UBLIK  150A3001    18823    16034               49148     3486     2091
UBLIK  150A3002      349                                1743       -1     3137
UBLIK  150A3003     1046                          17428             1394     2789     5577
UBLIK  150A3004                349     1743


         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

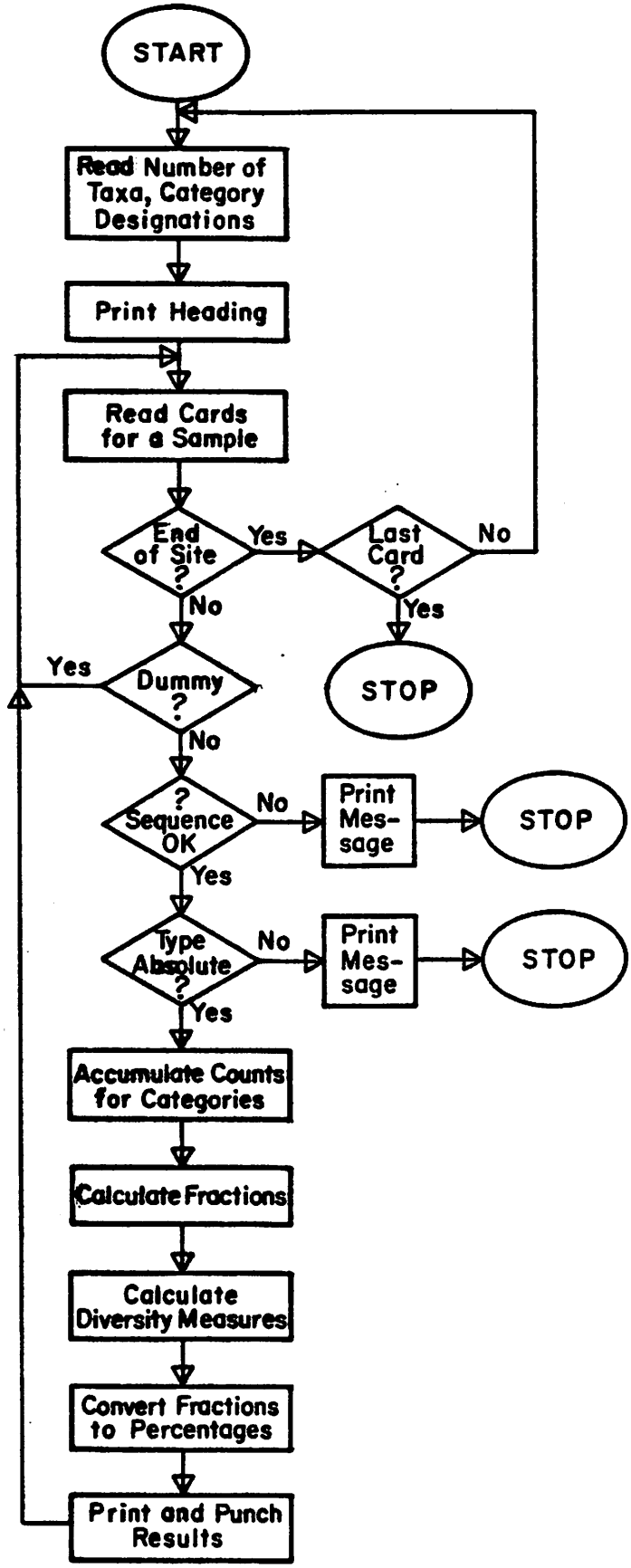
Figure 4.3. Card input to GROFORM (beginning only).

Program Listing for GROFORM

```
C     GROFORM
C
C   PROGRAM TO PUNCH SUMS OF LIFE FORM AND ECOLOGY TYPES AND TO CALCULATE
C     SIMPSON AND SHANNON DIVERSITY ESTIMATES
C
C    DEVELOPED IN 1975 BY MARGARET M. ECCLES
C    UNDER THE DIRECTION OF MARGARET HICKEY
C
C    CARD SETUP
C   1  NUMBER OF TAXA  COLUMNS 2-3
C   2  TAXA FOR LIFE FORM SUMS   ONE TAXON PER COLUMN
C        PUNCH 1 FOR TREES
C              2 FOR SHRUBS
C              3 FOR HERBS
C              4 FOR GRAMINOIDS
C              5 FOR MOSSES
C              6 FOR FERNS
C   3  TAXA FOR ECOLOGY SUMS   ONE TAXON PER COLUMN
C        PUNCH 1 FOR EXOTICS
C              2 FOR XERIC
C              3 FOR MESIC
C              4 FOR HYDRIC
C
C   4  DATA CARDS (AS OUTPUT BY POLDATA)
C      COLS.  1-5  SITE NAME
C             4-9  LEVEL OR LOCATION
C            11-13 NOT USED (CONTAINS LARGEST COUNT TOTAL)
C               14 CARD NUMBER
C            15-68 ABSOLUTE CALCULATED COUNTS FOR TAXA, UP TO EIGHT
C                  PER CARD IN 8-COLUMN FIELDS
C   5  BLANK CARD
C   NOTE: THE ABOVE SEQUENCE 1-5 MAY BE REPEATED FOR SEVERAL SITES
C
      PROGRAM GROFORM(INPUT,OUTPUT,PUNCH,TAPE5=INPUT)
      DIMENSION X(96),LSUM(96),ESUM(96),XL(6),XE(4),PL(6),
     .PE(4),LNAME(6),ENAME(4)
      INTEGER ESUM
      DATA NG/10/,NL/6/,NE/4/,IL,IE/1HL,1HE/
C
C   READ NUMBER OF TAXA
   10 READ 11,NTAXA
   11 FORMAT (I3)
C    READ LIFE FORM GROUP DESIGNATIONS
      READ 12,(LSUM(I),I=1,NTAXA)
   12 FORMAT (80I1)
C    READ ECOLOGY GROUP DESIGNATIONS
      READ 12,(ESUM(I),I=1,NTAXA)
C   PRINT HEADING
   90 PRINT 99
   99 FORMAT (*1 LOC TAXA      TOTAL     TREES    SHRUBS     HERBS      GRAM
     .    MOSSES     FERNS  SIMP  SHAN  EXOTICS     XERIC     MESIC    HYDRIC
     .   SHAN*)
C   READ DATA CARDS FOR A LEVEL (OR LOCATION)
  100 READ 101,ISITE,LOC,IT,KNT,IC,(X(I),I=1,NTAXA)
  101 FORMAT (A5,A4,R1,I3,I1,8F8.0/(14X,8F8.0)
C    CHECK FOR END OF SITE
      IF (IC.EQ.0) GO TO 200
C    CHECK FOR DUMMY LEVELS
      IF (LOC.EQ.1H ) GO TO 100
C    CHECK CARD SEQUENCE
      IF (IC.NE.1) GO TO 910
C    CHECK DATA TYPE (MUST BE ABSOLUTE)
      IF(IT.NE.1) GO TO 920
C   ZERO ACCUMULATORS
      DO 120 I=1,NG
  120 XL(I)=0.
      SUM=0.
      N=0
```

```
C  ADD TAXON COUNTS TO APPROPRIATE GROUPS
      DO 130 I=1,NTAXA
      IF(X(I).LE.0.)GO TO 130
C  J = LIFE-FORM CATEGORY
      J=LSUM(I)
      XL(J)=XL(J)+X(I)
C  J = ECOLOGY CATEGORY
      J=ESUM(I)
      XE(J)=XE(J)+X(I)
C  ACCUMULATE TOTAL COUNT AND NUMBER OF TAXA PRESENT
      SUM=SUM+X(I)
      N=N+1
  130 CONTINUE
C  CALCULATE FRACTION OF TOTAL
      DO 150 I=1,NG
      PL(I)=XL(I)/SUM
      IF (XL(I).LT.0.) PL(I)=0.
  150 CONTINUE
C  CALCULATE SIMPSON AND SHANNON DIVERSITY ESTIMATES
C   LIFE FORM
      DSIM=DSHANL=0.
      DO 170 I=1,NL
      IF(XL(I).LE.0.)GO TO 170
      DSIM=DSIM+XL(I)*(XL(I)-1)
      DSHANL=DSHANL-PL(I)*ALOG(PL(I))
  170 CONTINUE
      DSIM=SUM*(SUM-1.)/DSIM
C   ECOLOGY
      DSHANE=0
      DO 180 I=1,NE
      IF(PE(I).EQ.0.)GO TO 180
      DSHANE=DSHANE-PE(I)*ALOG(PE(I))
  180 CONTINUE
C  CONVERT FRACTIONS TO PERCENTS
      DO 185 I=1,NG
  185 PL(I)=PL(I)*100.
C  PRINT RESULTS
      PRINT 181,LOC,N,SUM,XL,DSIM,DSHANL,XE,DSHANE
  181 FORMAT(X,A4,I5,F10.0,6F9,F7.3,F6.3,F8,3F9,F6.3)
      PRINT 182,PL,PE
  182 FORMAT(20X,6F 9.1,12X,4F 9.1)
C   PREPARE RESULTS FOR PUNCHING
C  REDUCE 1000 TO 99.9 TO FIT CARD FORMAT AND MULTIPLY BY 10
C  TO AVOID EXTRA COLUMN FOR DECIMAL POINT
      DO 190 I=1,NG
  190 PL(I)=PL(I)*10
      I=1
C  PUNCH CARD OUTPUT - 3 CARDS PER LEVEL (OR LOCATION)
C      LIFE FORM - 2 CARDS
      PUNCH 191,ISITE,LOC,IL,KNT,I,N,SUM,XL
  191 FORMAT(A5,A4,A1,I3,I1,I3,F11.0,6F8.0)
      I=2
      PUNCH 192,ISITE,LOC,IL,KNT,I,PL,DSIM,DSHANL
  192 FORMAT(A5,A4,A1,I3,I1,6F4.0,2F5.3)
C      ECOLOGY - 1 CARD
      I=1
      PUNCH 193,ISITE,LOC,IE,KNT,I,N,SUM,XE,PE,DSHANE
  193 FORMAT(A5,A4,A1,I3,I1,I3,F11.0,4F8.0,4F4.0,F5.3)
      GO TO 100
C  CHECK FOR LAST CARD
  200 IF(EOF,5)210,10
  210 STOP
C  ERROR MESSAGES
  910 PRINT 911,IC,LOC
  911 FORMAT (*0CARDS OUT OF ORDER -*,I2,* WAS FIRST CARD FOR *,A4)
      STOP
  920 PRINT 921,IT,LOC
  921 FORMAT (*0DATA TYPE *,R1,* FOUND AT *,A4)
      STOP
      END
```

FLOW CHART FOR GROWFORM



5.0 DISPLAY

The DISPLAY program produces the instructions used by the automatic plotter in drawing the diagram for publication. An automatically plotted diagram costs substantially less in terms of time and money than a high quality diagram produced by a skilled draftsperson. An important aspect of this machine approach is the reduction of errors compared to the usual procedure of transmitting the data from the normal manual counting sheet to a rough diagram and then to a draftsperson. Repeated checking of our manually produced diagrams shows that errors can easily become incorporated in the published diagrams.

Production of the diagram is a two-step process. The plot instructions are generated by the DISPLAY program and preserved on magnetic tape. If the printed output from DISPLAY indicates that the diagram is complete and free of mistakes, the diagram is generated on the plotter using the instructions on the magnetic tape. If necessary, additional copies of the diagram may be made using this tape without rerunning the DISPLAY program.

5.1 Appearance of the Diagram

The diagram is organized in two dimensions, with samples along the vertical axis and taxa along the horizontal (see Figure 5.1). The count frequencies or percentages are represented by a horizontal histogram with a scale drawn at the top. If a taxon was not present for a given sample no line is drawn; a taxon that was present but not counted (i.e., found while scanning) is represented by a small "+". The right hand ends of the histogram are joined by line segments over any set of adjacent samples where the taxon value is nonzero. Where the taxon value is zero or a "presence only" symbol, the line segment from the adjacent

nonzero value is drawn to the baseline at the midpoint between the two samples.

If a sediment profile has a break in it, the break can be represented by a "dummy" or blank sample. The histogram is not connected across this blank level, as can be seen in Figure 5.2. The "dummy" sample also permits the presentation on a single diagram of traps, polsters or single fossil samples from several sites in one general area.

If two or more samples were taken at the same level in a sediment profile, the duplicate levels are plotted at half-intervals below the first; however, we normally average the results where duplicate levels have been prepared.

Each sample is identified at the far left side of the diagram. For profile samples a box is drawn which will later be completed by hand as a stratigraphic column; note its absence on Figure 5.3. Taxa are identified by a complete name (20-80 columns, depending on the height of the diagram) at the bottom of each vertical set of lines. The site identification and the data type are written across the top of the diagram.

For relative and absolute data types, optional summaries may appear on the right of the diagram. The summary for relative data is a percentage plot of a preliminary Growth Form diagram with up to three groupings (see Figure 5.1). For absolute data a summation of values of certain taxa designated as exotics is drawn (see Figure 5.2).

5.2 Size of Diagram

The depth of the diagram as drawn on the CALCOMP is limited by the width of the paper plotter (27.5 inches or 69.9 cm). The DISPLAY program reserves 3 inches of this (7.5 cm) for the title, scales, and scale-change notations at the top of the diagram. In order to leave enough room to write at least 20 columns of taxon names at the bottom, another 2.5 inches (6.3 cm) is reserved. Thus the body of the diagram may not exceed 22 inches (56 cm) in depth.

Samples are normally spaced at ½-inch (1.2-cm) intervals, allowing a maximum of 45 samples on one diagram. For all sample types except sediment profiles this is generally adequate, but for a sediment profile

with sampling interval of 2.5 cm, the depth is restricted to 110 cm. Longer sediment profiles are therefore plotted with a distance of ¼-inch (0.6 cm) between levels or samples. For a very long profile the interval between levels is reduced to 3/16 inch (0.5 cm), allowing up to 118 levels to be drawn. If more than 118 levels are present, the diagram must be divided into sections which can be produced separately and joined together for photoreduction.

The horizontal length of the diagram is variable, depending on the scales selected for the horizontal lines. If all taxa were drawn to the same scale there would be a tendency for a few very numerous taxa to predominate. Several scales may therefore be chosen so that taxa which are highly represented may be telescoped into a smaller space, and taxa which are sparsely represented may be expanded to show details of variation that would otherwise be lost. Any changes in scale across the diagram are noted at the top of the histogram.

Another situation which leads to the predomination of one or more taxa occurs when the values for a few, or even one, of the samples are substantially higher than for the rest. A maximum value is specified to take care of this; any value exceeding that value is not drawn to full length, but truncated to the specified value, and the line is then labeled with the value it represents.

The labels for samples have a fixed width of 2.2 inches (5.3 cm) for profiles (this includes the stratigraphic column) and 1 inch (2.5 cm) for all other types of samples. A minimum of 0.4 inches (1 cm) is allowed for each histogram; most taxa will, however, require more space than this for the largest value. A small margin (0.05 inches, 0.1 cm) is allowed for separation between histograms. The optional percentage plot for relative data has a fixed width of 1.4 inches (3.6 cm), but the size of the exotics summary for "absolute" data is variable and depends on the scale used.

5.3 Printed Output

Plotting of the diagram is fairly expensive, while the generation of the plot code is substantially less expensive. For this reason the printed output from DISPLAY contains information which should be checked to determine whether or not the diagram is ready to be drawn (see Figures

5.4, 5.5). The title, number of taxa, and taxa names are printed so that spelling or other errors may be detected. Then, for each data type to be processed for that site, the scales are printed, along with certain derived distances. Scales are specified as the value to be represented by 1 inch (2.5 cm), together with the value at which the horizontal line should be truncated. Derived values are the distance per unit value, distance between tick marks on the scale, and distance between labels on the scale, all in inches. (The distance between labels is usually twice the distance between tick marks.)

The program calculates the vertical height of the histograms and then determines how many characters may be plotted for the taxa names. This information is printed and the names may be checked to verify that none will be truncated.

For profile samples, the location of the top and bottom levels are indicated, as well as any breaks in the profile. The reference point is the top of the histograms, so the location will be expressed in inches preceded by a minus sign (Figure 5.4). For other sample types, each sample identification is listed, along with an order number (beginning with zero) and the location on the diagram in inches from the top (also negative) (Figure 5.5).

The horizontal dimensions of the diagram are then indicated. The beginning of a section is indicated by a note: "site names drawn here" or "depth scale drawn here," depending on the sample type. For each taxon the order number, group for summary (if used), scale number, name, and width of the histogram are listed. If a summary is to be made, each sample will be listed, along with the value(s) for each. The width of the summary is also printed, as is the width of the entire section, including all margins, labels and summaries.

5.4 Card Input (First Five Cards)

The first five cards (or sets of cards) required by the DISPLAY program are the same as (or very similar to) cards used for the PRPLOT and POLDATA programs. Any differences are noted.

The depth card, which is required for sediment profile samples and must not be used for any other type, is similar in use to the same card

used in the POLDATA and PRPLOT programs. The difference is that this card must contain, besides the word "DEPTH" in the first five columns, the interval between levels punched in columns 11-15. Since most profiles analyzed by this laboratory are sampled at intervals of 2.5 cm, the program will assume this interval if none is specified. If the sampling intervals are irregular, then the value used should be that of the smallest interval.

A title card specifies the site identification to appear at the top of each section of the diagram. The first card punched by the POLDATA program is generally adequate.

The number of taxa is indicated on the next card in columns 2-3. In the case of Growth Form and Ecology diagrams this should be the number of items calculated and punched by program GROFORM (16 and 11, respectively).

Taxon names are in the format used by the PRPLOT program, i.e., one taxon name (or item label, in the case of Growth Form or Ecology diagrams) per card. Up to 80 columns are available, though not all may be used by the program if the number of samples is large. Names should begin in the first column of the card. A taxon (or other item) may be omitted by replacing the appropriate name card with a card entirely blank except for a minus sign in column 1.

The data type is specified by the next card. The program will accept any of the following types: relative, "absolute," scan, Growth Form, or Ecology. The name must begin in the first column of the card, as it is this column that identifies the type.

5.5 Scale Information

Scaling of the data values is critical in the DISPLAY program, in order to produce a well-balanced diagram. Unlike PRPLOT, each taxon (or other item) is assigned a scale individually rather than treating them in groups.

A maximum of eight different scales may be specified. Two cards are required, the first for the values represented by 1 inch (2.5 cm), and the second for the truncation values. If the scale is the same but the truncation value varies, different scales must be indicated. Each

value is punched in a 10 column field. A representative set of scales for a Growth Form diagram is shown:

25	200000	40000	2	1
100	800000	80000	3	1

These scales are more widely varied than would be the scales for "absolute," relative, or scan data. The first is designed for a histogram of the number of taxa present for each sample, with a maximum width of 4 inches (10.1 cm). The next is for the total number of pollen grains for the sample, with a maximum width of 4 inches (10.1 cm). The third and fourth are for the "absolute" and percentage values of each of the Growth Form groups. The maximum widths for these are 2 and 1.5 inches (5.1 and 3.9 cm). The fifth scale is for the diversity measures, with a maximum width of 2 inches (2.5 cm).

The next card assigns a scale to each taxon. Each card column corresponds to a taxon or other variable, such as group or diversity measure. The scale number for the first taxon is punched in column 1, for the second in column 2, etc. For "absolute" data, if an exotics summary is desired a scale number for the summary is punched in column K, where K = number of taxa + 1.

5.6 Summary Information

These cards are used only for relative or "absolute" data. Each card column corresponds to a taxon, as for the scale assignment described above. The number to be punched is the group to which the taxon is assigned. If the taxon is not included in the summary, a zero is punched or the column is left blank. Only one group is allowed for "absolute" data, and up to three for relative.

A second card is required for the summary, but the information provided is different for "absolute" or relative data.

For relative data, the group names must be provided. These are punched in ten-column fields on a single card.

For "absolute" data, section indicators are required. It is not at all uncommon for the "absolute" diagram to be far too long in proportion to the depth to be suitable for publication. If this is the case, it

may be divided into two or three sections. These sections are specified by the section indicator card:

Data Field (Card Columns)	Contents of Field
1-3	Number of last taxon to be included in first section
4-6	Number of last taxon to be included in second section
7-9	Number of last taxon to be included in third section

If the first number is equal to (or greater than) the number of taxa, then all taxa are included in one section. Similarly, two sections are drawn if the second number is equal to (or greater than) the number of taxa.

The fossil exotic pollen summary may be drawn at the end of any section, as long as all taxa included in the summary have occurred in the section(s) already drawn. If, for example, there are 35 taxa, 14 of which are to be grouped in one section, 12 in a second section, and 9 in a third, and if all taxa in the exotics summary are in the first two sections, then the summary may be drawn at the end of the second section. This is indicated by punching a minus sign in front of the taxon number for section two. If the exotics summary is not indicated in an earlier section it will automatically appear at the end of the last (or only) section.

5.7 Data Cards

The data cards are those produced by the POLDATA or GROFORM programs. The format is as follows:

Data Field (Card Columns)	Contents of Field
1-5	Site identification
6-9	Sample identification
10	Data type
11-13	Ignored
14	Card number
15-78	Data fields - see POLDATA and GROFORM for details

"Dummy" samples may be inserted in the data deck. The format for these is as follows:

Data Field (Card Columns)	Contents of Field
1-5	Site identification
6-9	Blank
10	Data type
11-13	Blank
14	Card number
15-80	Blank

There must be the same number of cards for a dummy sample as for all others.

The end of the data for a particular data type is indicated by a blank card (two for Life Form data).

5.8 Card Sequences

Several data types may be drawn at once by repeating the sequence from the data type card to the blank card as often as desired.

If several diagrams are to be drawn at once, an end-of-record card must follow the blank card that signals the end of the data. The card setup may then be repeated from the beginning.

Figure 5.6 gives examples of card sequences.

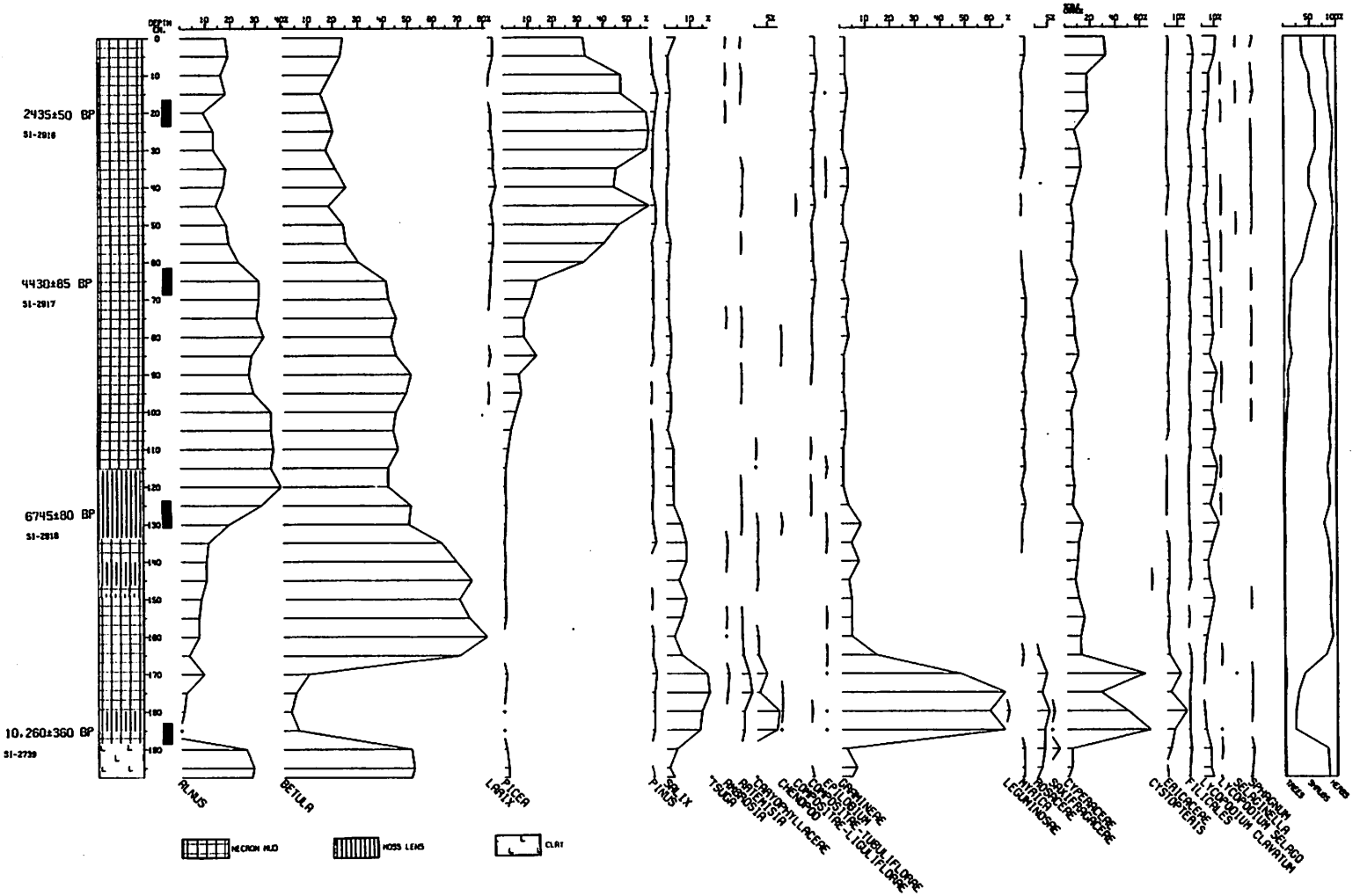


Figure 5.1. Typical diagram, finished and photoreduced (Ublik Pond, Labrador, relative data).

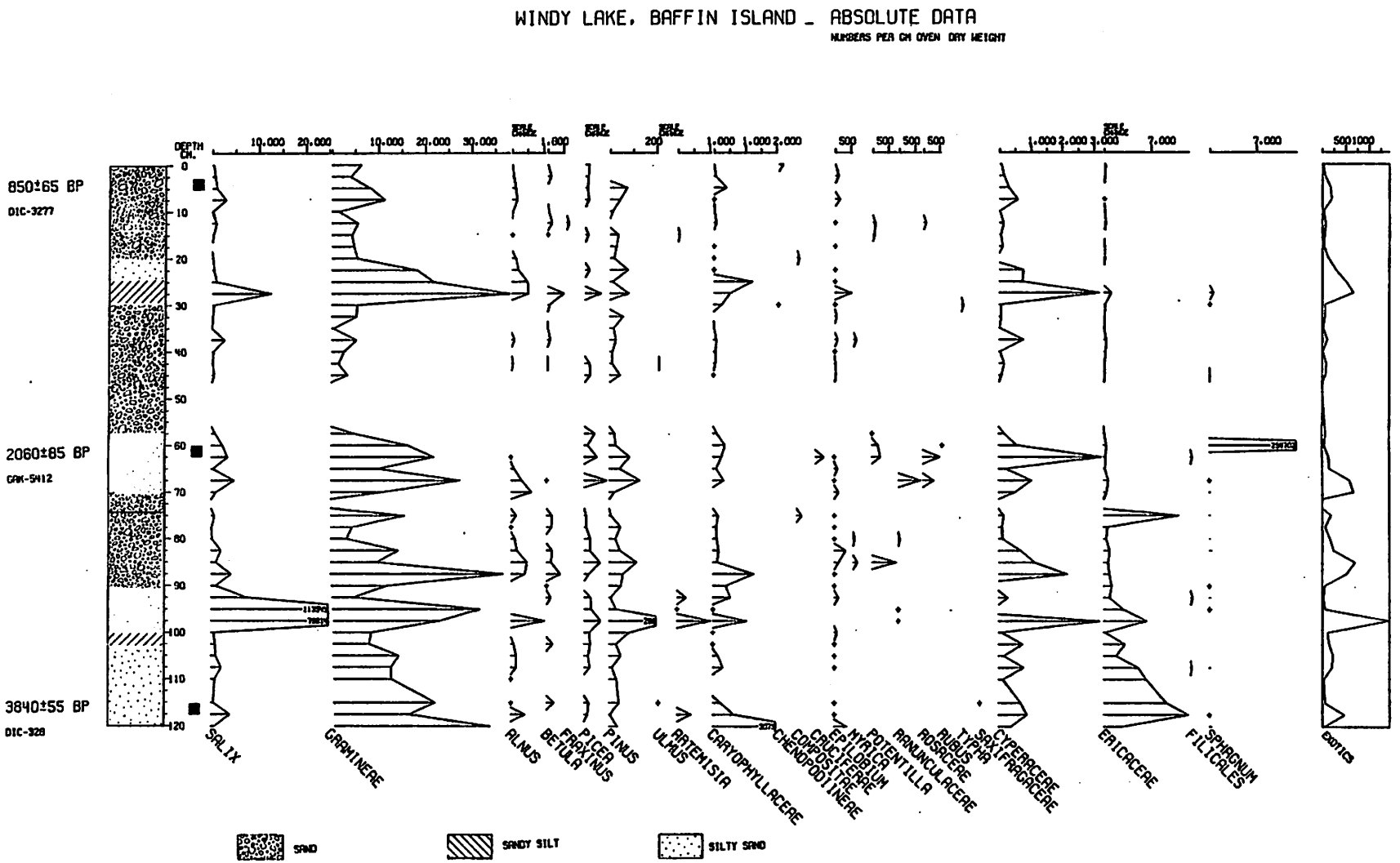


Figure 5.2. Similar diagram for a profile with breaks and dummy levels (absolute data).

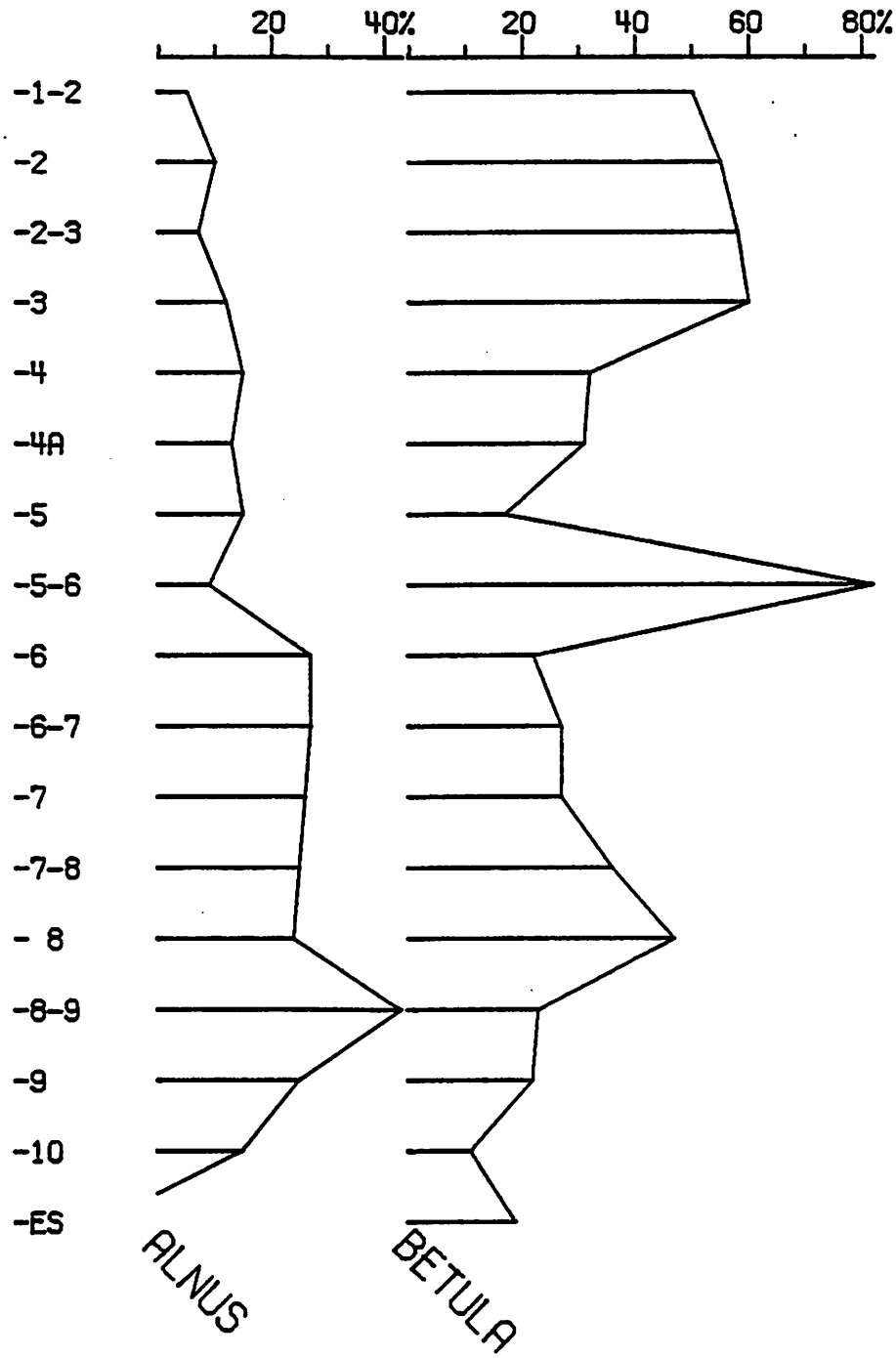


Figure 5.3. Detail from a diagram for a set of single fossil samples, unfinished and not photoreduced. Note the absence of the box for the stratigraphic column.

```
ABSOLUTE  DATA

SCALES
                      1          2          3
   1 INCH =        1000       5000        500
TRUNCATE AT        4000      15000       1000
LABEL EVERY        1000       5000        500
IN. PER CNT    .001000    .000200    .002000
IN. PER TCK        .50        .50        .50
IN. PER LAB       1.00       1.00       1.00

FOSSIL SEDIMENT PROFILE:

INTERVAL IS   1.0 CM   PLOTTED AS   .25 INCHES

 HIGHEST LEVEL 156.0 CM PLOTTED AT  0.00 INCHES

GAP FROM LEVEL 178.0 CM PLOTTED AT -5.50 INCHES

      TO LEVEL 214.0 CM PLOTTED AT -6.00 INCHES

GAP FROM LEVEL 224.0 CM PLOTTED AT -8.50 INCHES

      TO LEVEL 277.0 CM PLOTTED AT -9.00 INCHES

  LOWEST LEVEL 292.0 CM PLOTTED AT-12.75 INCHES

80 LETTERS OF TAXON NAME WILL BE DRAWN
DEPTH SCALE DRAWN HERE

TAXA  GROUP  SCALE                          WIDTH OF GRAPH
  1      1      1                               .40          ACER
  2      1      1                               .40          ALNUS
  3      0      1                               .40          BETULA
  4      1      1                               .40           UGLANS
  5      1      1                               .40           ICEA
  6      1      1                               .40          PINUS
  7      0      1                              4.05          SALIX
  8      1      1                               .40          ULMUS
  9      1      1                               .40          AMBROSIA
 10      0      1                               .40          ARTEMISIA
 11      0      1                               .40          CARYOPHYLLACEAE
 12      1      1                               .40          CHENOPOD
 13      0      1                               .40          CIRCEA
 14      0      1                               .40          COMPOSITAE
 15      0      1                               .40          CRUCIFERAE
 16      0      1                               .40          EPILOBIUM
 17      0      1                              4.05          GRAMINEAE
 18      1      1                               .40          MYRICA
 19      0      1                               .40           OSACEAE
 20      0      1                               .40          RUBUS
 21      0      1                               .40          SAXIFRAGA
 22      0      1                               .40          UMBELLIFERAE
 23      0      1                               .40          VIBURNUM
 24      0      2      SCALE CHANGE            3.05           YPERACEAE
 25      0      1      SCALE CHANGE             .65          ERICACEAE
 26      0      1                               .40           ICALES
 27      0      1                               .40          LYCOPODIUM SELAGO
 28      0      1                               .40           PHIGLOSSACEAE
 29      0      1                               .40           PHAGNUM
```

Figure 5.4. Printed output from DISPLAY for a profile with breaks.

```
RELATIVE  DATA

SCALES
                      1          2          3          4
   1 INCH =          25         25         50         25
TRUNCATE AT         100         50        100        100
LABEL EVERY          20         20         50         20
IN. PER CNT    .040000    .040000    .020000    .040000
IN. PER TCK         .40        .40        .50        .40
IN. PER LAB         .80        .80       1.00        .80

 LIST OF SAMPLES
                    0      0.00
                    1      -.50
                    2     -1.00
                    3     -1.50
                    4     -2.00
                    5     -2.50
                    6     -3.00
                    7     -3.50
                    8     -4.00
                    9     -4.50
                   10     -5.00
                   11     -5.50
                   12     -6.00
                   13     -6.50
                   14     -7.00
                   15     -7.50
                   16     -8.00

80 LETTERS OF TAXON NAME WILL BE DRAWN

SITE NAMES DRAWN HERE

TAXA  GROUP  SCALE                          WIDTH OF GRAPH
   1      2      1                               1.77        ALNUS
   2      2      1                               3.33        BETULA
   3      1      1                                .41        PICEA
   4      1      1                                .40        PINUS
   5      2      1                               1.25        SALIX
   6      3      1                                .40        ARTEMISIA
   7      3      1                                .53        CARYOPHYLLACEAE
   8      3      1                                .40        CHENOPOD
   9      3      1                                .40        COMPOSITAE-LIGULIFLORAE
  10      3      1                                .40        COMPOSITAE-TUBULIFLORAE
  11      3      1                                .40        EPILOBIUM
  12      3      1                               1.69        GRAMINEAE
  13      2      1                                .40        MYRICA
  14      3      1                                .40        POLYGONUM
  15      3      1                                .40        ROSACEAE
  16      0      2                               2.05        CYPERACEAE
  17      0      3      SCALE CHANGE             2.05        ERICACEAE
  18      3      1      SCALE CHANGE              .89        FILICALES
  19      3      1                               1.29        LYCOPODIUM CLAVATUM
  20      3      1                                .40        LYCOPODIUM SELAGO
  21      0      1                                .40        SPHAGNUM
```

Figure 5.5. Printed output from DISPLAY for a set of single fossil samples, including summary.

SUMMARY

LEVEL	TREES	SHRUBS	HERBS
0.0	3.3	69.7	27.1
1.0	6.7	80.4	12.9
2.0	6.3	72.9	20.9
3.0	5.2	77.2	17.5
4.0	5.7	74.5	19.9
5.0	4.0	45.5	50.5
6.0	8.3	41.8	49.8
7.0	2.0	91.4	6.7
8.0	4.7	80.0	15.3
9.0	9.7	82.9	7.4
10.0	9.1	72.9	18.0
11.0	5.6	66.8	27.5
12.0	3.0	78.8	18.2
13.0	9.0	79.0	12.0
14.0	7.1	49.5	43.4
15.0	6.0	53.0	41.0
16.0	12.1	19.2	68.7

LENGTH=1.40

TOTAL LENGTH OF THIS SECTION = 22.56 INCHES

END OF PLOT FILE

Figure 5.5 (cont.)

```
CARD COLUMN:
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

DEPTH       1.0
OWL RIVER, BAFIN ISLAND
 29
ACER
ALNUS
BETULA
JUGLANS
PICEA
PINUS
SALIX
ULMUS
AMBROSIA
ARTEMISIA
CARYOPHYLLACEAE
CHENOPOD
CIRCEA
COMPOSITAE
CRUCIFERAE
EPILOBIUM
GRAMINEAE
MYRICA
ROSACEAE
RUBUS
SAXIFRAGA
UMBELLIFERAE
BOTRYCHIUM
CYPERACEAE
ERICACEAE
FICALES
LYCOPODIUM SELAGO
OPHIGLOSSACEAE
SPHAGNUM
ABSOLUTE
      1000      5000       500
      4000     15000      1000
11111111111111111111112111113
11011101100100000100000000000
 29 29
OWLR 1560A1021              39      15              8       8     139
OWLR 1560A1022               8                      8       8
OWLR 1560A1023     550       8                                          4057
OWLR 1560A1024      31
OWLR 1570A1001              77      77              12      17    1916
OWLR 1570A1002                      38      38
OWLR 1570A1003    1571              38                                 11264
OWLR 1570A1004     192

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

a. For a profile, absolute data (beginning only).

Figure 5.6. Samples of card input to DISPLAY.

```
CARD COLUMN:
        1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

ROSE ISLAND, LABRADOR
 21
ALNUS
BETULA
PICEA
PINUS
SALIX
ARTEMISIA
CARYOPHYLLACEAE
CHENOPOD
COMPOSITAE-LIGULIFLORAE
COMPOSITAE-TUBULIFLORAE
EPILOBIUM
GRAMINEAE
MYRICA
POLYGONUM
ROSACEAE
CYPERACEAE
ERICACEAE
FILICALES
LYCOPODIUM CLAVATUM
LYCOPODIUM SELAGO
SPHAGNUM
RELATIVE
        25        25        50        25
       100        50       100       100
11111111111111231111
22112333333233003330
TREES      SHRUBS     HERBS
ROSEI1-2 R3001   5  50   3  .3  15  .3   3              .3  23  .3       .7  10
ROSEI1-2 R3002  37                .3
ROSEI2   R3001  10  55   6  .7  16       2                  11                10
ROSEI2   R3002  46                .3
ROSEI2-3 R3001   7  58   6  .3   8  1  .3         .7       18  .3       1   18
ROSEI2-3 R3002  51                .3
ROSEI3   R3001  12  60   5  .3   6       .7                 16               1   19
ROSEI3   R3002  53                .7

        1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

b. For a set of single fossil samples, relative data (beginning only).

Program Listing for DISPLAY

```
C     DISPLAY
C
C    PROGRAM TO DRAW POLLEN DIAGRAMS ON THE CALCOMP PLOTTER
C    WRITTEN 1974-1975 BY MARGARET M. ECCLES
C    UNDER THE DIRECTION OF MARGARET HICKEY
C
C    CARD SET-UP
C
C     1  DEPTH CARD - FOR SAMPLES TAKEN FROM SUCCESSIVE LEVELS AT A SITE
C       COLS. 1- 5  DEPTH
C            11-15  INTERVAL BETWEEN LEVELS (MAY BE LEFT BLANK
C                   IF INTERVAL IS 2.5 CM)
C     2  TITLE CARD - UP TO 80 COLUMNS OF INFORMATION AT TOP
C                     OF EACH SECTION OF THE DIAGRAM
C     3  NUMBER OF TAXA (OR GROUPS) - COLS. 2-3
C     4  TAXA NAMES - ONE NAME PER CARD, UP TO 20 COLUMNS
C                     BEGINNING IN COLUMN 1
C     5  DATA TYPE - BEGINNING IN COL.1. ACCEPTABLE DATA TYPES ARE:
C              RELATIVE, ABSOLUTE, SCAN, LIFE FORM, ECOLOGY
C     6  SCALE INFORMATION - UP TO 8 DIFFERENT SCALES MAY BE
C                            SPECIFIED BY THE NEXT TWO CARDS.
C         A  NUMBER PER INCH (POLLEN GRAINS OR PERCENT)
C         B  CUTOFF POINT (SAME UNITS)
C        THE FORMAT FOR BOTH CARDS IS AS FOLLOWS:
C           COLS. 1-10  VALUE FOR FIRST SCALE
C                 11-20  VALUE FOR SECOND SCALE
C                  ...   ...
C                 71-80  VALUE FOR EIGHTH SCALE (IF NEEDED)
C     7  SCALE NUMBERS - ASSIGNS A SCALE TO EACH TAXON
C           COL. 1  SCALE NUMBER FOR FIRST TAXON
C                2  SCALE NUMBER FOR SECOND TAXON
C               ... ...
C               ETC. FOR UP TO 96 TAXA
C           FOR ABSOLUTE DATA SPECIFY SCALE FOR EXOTICS SUMMARY
C               (IF ANY) IN COL. NO. NTAXA+1
C              (WHERE NTAXA = NUMBER OF TAXA)
C     8  SUMMATION INFORMATION (TYPES RELATIVE AND ABSOLUTE ONLY)
C         SPECIFIES TAXA TO BE SUMMED AND PLOTTED AS A UNIT AT END OF
C         DIAGRAM.  THREE GROUPS ARE PERMITTED FOR RELATIVE DATA, TO BE
C         CONVERTED TO PERCENTAGES BEFORE PLOTTING.  ONLY ONE GROUP IS
C         PERMITTED FOR ABSOLUTE, TO BE LABELED EXOTICS.  THIS WILL NOT
C         BE CONVERTED TO PERCENTAGES.  SPECIFY GROUP ZERO FOR TAXA
C         NOT TO BE INCLUDED IN SUMMARY.
C       COL. 1  GROUP NUMBER FOR FIRST TAXON
C            2  GROUP NUMBER FOR SECOND TAXON
C           ... ...
C           ETC FOR UP TO 80 TAXA (BEGIN A SECOND CARD IF MORE THAN 80)
C     9  FOR RELATIVE ONLY:
C          COLS. 1-10  NAME OF FIRST GROUP
C                11-20  NAME OF SECOND GROUP
C                21-30  NAME OF THIRD GROUP
C        FOR ABSOLUTE ONLY:
C          B  SECTION INDICATORS - UP TO THREE SECTIONS MAY BE SPECIFIED.
C                THE EXOTICS SUMMARY (IF ANY) WILL BE PLOTTED AT THE END
C                OF THE LAST SECTION OR AFTER THE SECTION WHOSE INDICATER
C                IS PRECEDED BY A MINUS SIGN.
C              COLS. 1-3  ORDER NUMBER OF LAST TAXON IN FIRST
C                         SECTION
C                    4-6  ORDER NUMBER OF LAST TAXON IN SECOND
C                         SECTION
C                    7-9  ORDER NUMBER OF LAST TAXON IN THIRD
C                         SECTION
```

```
C    10  DATA
C    11  BLANK CARD
C  NOTE:  SEVERAL DATA TYPES FOR THE SAME LOCATION MAY BE
C    PLOTTED BY REPEATING 5-11.
C         SEVERAL LOCATIONS MAY BE PLOTTED BY USING AN
C    END-OF-RECORD CARD AND THEN REPEATING 1 - 11.
C
      PROGRAM DISPLAY(INPUT,OUTPUT,TAPE4,TAPE5=INPUT)
      COMMON L,YBOT,D(120),X(120),C(120,96),XSUM(4,120),GNAME(3)
      COMMON /D/ ITY,ITYPE,TYPE
      COMMON /N/ IDUM(120),IDEPTH,NAME(120),DEPTH(120),SITE,DINT
      COMMON /S/ SCLFACT(8),XTICK(8),XLAB(8),LABINC(8),
     .CUTOFF(8),NSC(97),NSX
      COMMON /T/ TL,TITLE(8)
      COMMON /Y/ YINT,ITRUNC,YSZERO,YSTRUNC
      DIMENSION LABEL(8,96),IGR(3),ISUM(96)
      INTEGER SITE
    1 CONTINUE
      DINT=1.
      IEX=ISTOP=IDEPTH=ISTART=0
C         READ TITLE AND NAME CARDS
   10 READ 11,TITLE
   11 FORMAT (8A10)
   12 FORMAT (F5.0)
   17 FORMAT (1H1)
      IF (EOF,5) 990,20
   20 IF (TITLE.NE.5HDEPTH) GO TO 30
   21 FORMAT (1H0,12A10)
   22 FORMAT (26I3)
   23 FORMAT (5F10)
      IDEPTH=1
      DECODE(5,12,TITLE(2)) DINT
      IF (DINT.EQ.0) DINT=2.5
      GO TO 10
   30 CONTINUE
      PRINT 17
      PRINT 21,TITLE
      CALL FLENGTH(TITLE)
C           NUMBER OF TAXA
      READ 22,NTAXA
      PRINT 21
      PRINT 22,NTAXA
C        TAXA NAMES
      READ  11,((LABEL(I,J),I=1,8),J=1,NTAXA)
      PRINT 21,((LABEL(I,J),I=1,3),J=1,NTAXA)
C           TYPE OF DATA
      READ 26,ITYPE
   26 FORMAT (R1)
  100 CONTINUE
      CALL SETTYPE
C           SCALE INFORMATION
      CALL RSCALES
      READ 61,(NSC(I),I=1,NTAXA),NSX
   61 FORMAT (80I1)
      IF (ITY.GT.2) GO TO 180
C        TAXA TO BE INCLUDED IN SUMS
      READ 61,(ISUM(I),I=1,NTAXA)
      ISUMM=0
      DO 130 I=1,NTAXA
      IF (ISUM(I).EQ.0) GO TO 130
      ISUMM=1
      GO TO 140
  130 CONTINUE
  140 CONTINUE
      IF (ITY.EQ.2) GO TO 170
C          NAMES FOR GROUPS (RELATIVE ONLY)
      READ 11,GNAME
      GO TO 180
  170 CONTINUE
```

```
C          SECTION INDICATORS (ABSOLUTE ONLY)
      READ 22,IGR
  180 CONTINUE
C   ZERO ACCUMULATORS FOR SUMMARY
      DO 190 I=1,480
  190 XSUM(I)=-0.
C          READ DATA CARDS
      CALL READATA(ISTOP,NTAXA)
      IF (L.EQ.0) GO TO 950
C           CHECK Y-AXIS (DEPTH OF SAMPLE)
      CALL VSCALE(NLET,DEPTH,DINT)
      LSC=NSC(1)
      IG=1
      IF (ISTART.EQ.1) GO TO 300
      CALL PSTART(25,4)
      CALL PORGN(0.,25.)
      ISTART=1
  300 CONTINUE
      CALL YAXIS
      PRINT 301
  301 FORMAT (*0TAXA  GROUP  SCALE*,19X,*WIDTH OF GRAPH*)
C          PLOT EACH TAXA
      DO 390 J=1,NTAXA
C        SKIP TAXON WITH NAME 1H-
      IF (LABEL(1,J).EQ.1H-) GO TO 390
      IF (ITY.NE.2) GO TO 310
      IF (J.LE.IABS(IGR(IG))) GO TO 310
C        DRAW LABELS OR SCALES BETWEEN GROUPS (ABSOLUTE ONLY)
      IF (IGR(IG).LT.0) CALL EXOTICS
      IF (IGR(IG).LT.0) IEX=1
      IG=IG+1
      CALL TITLER
      CALL YAXIS
      LSC=NSC(J)
  310 CONTINUE
C        GET SCALE FACTOR AND BEGIN SUMMARY PRINT
      K=NSC(J)
      XSCALE=SCLFACT(K)
      PRINT 311,J,ISUM(J),K
  311 FORMAT (I4,I6,I7)
      IF (LSC.EQ.K) GO TO 320
C        INDICATE SCALE CHANGE OF THERE WAS ONE
      IF (SCLFACT(LSC).EQ.XSCALE) GO TO 320
      CALL SYMBOL(0.,.75,.1,5HSCALE,0.,5)
      CALL SYMBOL(0.,.62,.1,6HCHANGE,0.,6)
      LSC=K
      PRINT 318
  318 FORMAT (1H+,22X,*SCALE CHANGE*)
  320 CONTINUE
      XMAX=0
      LZ=1
      ITRUNC=0
      KZ=0
C        BEGIN LOOP OVER LEVELS
      DO 380 I=1,L
C        CHECK FOR DUMMY LEVEL
      IF (IDUM(I).EQ.1) GO TO 360
      IF (C(I,J).EQ.0.) GO TO 360
C        CHECK FOR SCAN
      IF (C(I,J).LT.0.) GO TO 350
      KZ=1
      X(I)=C(I,J)*XSCALE
      IF (ISUM(J).LE.0) GO TO 330
C        ACCUMULATE FOR SUMS
      IJ=ISUM(J)
      XSUM(IJ,I)=XSUM(IJ,I)+C(I,J)
      IF (ITY.NE.1) GO TO 330
C   SUM OF GROUPS (RELATIVE ONLY)
      XSUM(4,I)=XSUM(4,I)+C(I,J)
  330 CONTINUE
```

```
      XI=X(I)
      IF (C(I,J).LE.CUTOFF(K)) GO TO 340
C        TRUNCATE VALUES THAT EXCEED CUTOFF
      X(I)=CUTOFF(K)*XSCALE
      NTENS=KU(INT(C(I,J)),10)
      IF (NTENS.GE.0) GO TO 335
      PRINT 334,C(I,J),I,DEPTH(I)
  334 FORMAT (022,*  LEVEL*,I3,F6.1)
      NTENS=8
  335 XX=NTENS*.09+.1
      XMAX=X(I)
      XI=X(I)-XX
      CALL NUMBER(XI+.04,D(I)-.05,.10,C(I,J),0.,-1)
      ITRUNC=ITRUNC+1
      CALL TRUNC(I,LZ,KZ,J)
  340 CONTINUE
C        KEEP LENGTH OF LONGEST LINE
      IF (X(I).GT.XMAX) XMAX=X(I)
C        DRAW BAR
      CALL PLOT(0.,D(I),3)
      CALL PLOT(XI,D(I),2)
      GO TO 380
C        PLOT SYMBOL FOR SCAN
  350 CONTINUE
C     CALL SYMBOL(.01,D(I)+.01,H,3,0.,-1)
      CALL SYMBOL(0.,D(I),.14,3,0.,-1)
  360 X(I)=0.
      IF (I.EQ.1) GO TO 380
      IF (KZ.EQ.0) GO TO 370
C        CONNECT BARS IF ZERO VALUES OR SCANS OCCUR
      CALL CONNECT(X(LZ),D(LZ),I,LZ)
      KZ=0
  370 LZ=I+1
C        END OF LOOP OVER LEVELS
  380 CONTINUE
C        CONNECT ANY BARS LEFT UNCONNECTED
      IF (KZ.EQ.1) CALL CONNECT(X(LZ),D(LZ),L+1,LZ)
C        DRAW NAME AT BOTTOM
      CALL SYMBOL(-.1,YBOT-.2,.21,LABEL(1,J),315.,NLET)
C           PLOT SCALE AT TOP
      CALL DRAWSCL(XMAX,XTICK(K),XLAB(K),LABINC(K),J)
      XMAX=AMAX1(.4,XMAX+.05)
C        PRINT REST OF SUMMARY INFORMATION
      PRINT 381,XMAX,(LABEL(I,J),I=1,3)
  381 FORMAT (1H+,F43.2,10X,3A10)
      CALL NEWORIG(XMAX)
C        END OF LOOP OVER TAXA
  390 CONTINUE
C        DO EXOTICS SUMMARY IF REQUESTED AND IF NOT DONE PREVIOUSLY
      IF (IEX.EQ.0.AND.ISUMM.EQ.1.AND.ITY.LE.2) CALL EXOTICS
      CALL TITLER
      IF (ISTOP.EQ.1) GO TO 180
C        READ NEXT CARD
      READ 26,ITYPE
      IF (EOF,5) 900,100
C        END PLOT FILE
  900 PRINT 901
  901 FORMAT (*0END OF PLOT FILE*)
      CALL PEND(-XX+4)
      GO TO 1
  990 STOP
C        ERROR MESSAGES
  950 PRINT 951
  951 FORMAT (*0NO DATA OR DATA TYPE BLANK*)
      STOP
      END
C
C**********************
C
```

```
      SUBROUTINE TLENGTH
C   SUBROUTINE TO READ TITLE AND DETERMINE ITS LENGTH
      COMMON /D/ ITY,ITYPE,TYPE
      COMMON /T/ TL,TITLE(8)
      DIMENSION NN(5)
      DATA NN/8,8,4,9,7/
      DATA W,H/.24,.28/
C
      DO 450 I=1,8
      J=9-I
      A=TITLE(J)
      IF (A.EQ.1H ) GO TO 450
      DO 440 K=1,10
      IF ((A.AND.77B).NE.1R ) GO TO 460
  440 A=ARS(A,6)
  450 CONTINUE
      PRINT 451
  451 FORMAT (*0BLANK TITLE*)
      J=0
      RETURN
  460 J=10*(J-1)+11-K
      RETURN
C
C   ENTRY POINT TITLER WRITES TITLE AND DATA TYPE CENTERED
C       AT THE TOP OF A SECTION OF THE DIAGRAM
C
      ENTRY TITLER
      PRINT 431,TL
  431 FORMAT (*0TOTAL LENGTH OF THIS SECTION =*,F6.2,* INCHES*)
  470 CONTINUE
      XJ=J*W
      ND=NN(ITY)
      XX=(TL-XJ-ND*W-1.92)*.5
      IF (XX.LT.0.) GO TO 490
      XX=XX-TL
      CALL SYMBOL(XX,3.,H,TITLE,0.,J)
      XX=XX+XJ+W
      CALL SYMBOL(XX,3.14,H,15,0,-1)
      XX=XX+2*W
      CALL SYMBOL(XX,3.,H,TYPE,0.,ND)
      XX=XX+ND*W+W
      CALL SYMBOL(XX,3.,H,4HDATA,0.,4)
      RETURN
  490 PRINT 491,XJ
  491 FORMAT (*0TITLE IS TOO LONG*,F7.2)
      RETURN
      END
C
C**********************
C
      SUBROUTINE SETTYPE
C   SUBROUTINE TO DETERMINE DATA TYPE AND SET FLAGS
C     (RETURNED IN COMMON /D/  )
C    ITYPE IS RIGHT-ADJUSTED FIRST LETTER OF TYPE
C         (DISPLAY CODE - EQUALS SEQUENCE NO. IN ALPHABET)
C    TYPE IS COMPLETE NAME
C    ITY IS CODE (1-5)
      COMMON /D/ ITY,ITYPE,TYPE
      DIMENSION DTYPE(5),JTYPE(5)
      DATA DTYPE/8HRELATIVE,8HABSOLUTE,4HSCAN,8HLIFEFORM,7HECOLOGY/
      DATA JTYPE/18,1,19,12,5/
C
      DO 60 I=1,5
      IF (ITYPE.EQ.JTYPE(I)) GO TO 80
   60 CONTINUE
      PRINT 61,ITYPE
   61 FORMAT (*0ILLEGAL DATA TYPE SPECIFIED  -*,R1,1H-)
      STOP
   80 ITY=I
      TYPE=DTYPE(I)
```

```
      PRINT 81,TYPE
   81 FORMAT (1H1,A10,*DATA*)
      RETURN
      END
C
C**********************
C
      SUBROUTINE RSCALES
C    SUBROUTINE TO READ SCALE INFORMATION AND DETERMINE
C       INTERVALS FOR LABELS AND TICK MARKS
      COMMON /S/ SCLFACT(8),XTICK(8),XLAB(8),LABINC(8),
     .CUTOFF(8),NSC(97)
      DIMENSION CPI(8)
      READ 3,CPI,CUTOFF
    3 FORMAT (8F10)
      DO 50 I=1,8
      IF (CPI(I).EQ.0.) GO TO 60
      SCLFACT(I)=1./CPI(I)
      K=CPI(I)
      K=KU(K,10)+1
      K=K+K/3
      W=K*.12+.35
C    N IS SMALLEST NUMBER POSSIBLE FOR LABELING INTERVAL
C             TO AVOID CROWDING
      N=W*CPI(I)
      IF(N.LT.10) N=10
      K=KU(N,10)
C    IX IS LARGEST POWER OF 10 LESS THAN N
      IX=10**K
      JX=IX/2
C    M IS SMALLEST NUMBER SUCH THAT M*JX IS GREATER THAN N
      M=(N+JX-1)/JX
C    IF M IS EVEN WORK WITH IX
      IF (MOD(M,2).EQ.0) GO TO 20
C    IF M IS NOT 5 WORK WITH IX
      IF (M.NE.5) GO TO 10
      IX=JX
      GO TO 40
   10 M=M+1
   20 M=M/2
      IF (M.LT.3) GO TO 40
      IF (M.LT.5) M=5
      IF (M.GT.5) M=10
   40 LABINC(I)=M*IX
      XLAB(I)=LABINC(I)*SCLFACT(I)
      XTICK(I)=XLAB(I)*.5
   50 CONTINUE
      I=9
   60 IF (I.EQ.0) GO TO 90
      I=I-1
      PRINT 61,(J,J=1,I)
   61 FORMAT (*0SCALES*/10X,8I10)
      PRINT 62,(CPI(J),J=1,I)
   62 FORMAT (*     1 INCH =*,8F10)
      PRINT 63,(CUTOFF(J),J=1,I)
   63 FORMAT (* TRUNCATE AT*,8F10)
      PRINT 64,(LABINC(J),J=1,I)
   64 FORMAT (* LABEL EVERY*,8I10)
      PRINT 65,(SCLFACT(J),J=1,I)
   65 FORMAT (* IN. PER CNT*,8F10.6)
      PRINT 66,(XTICK(J),J=1,I)
   66 FORMAT (* IN. PER TCK*,8F10.2)
      PRINT 67,(XLAB(J),J=1,I)
   67 FORMAT (* IN. PER LAB*,8F10.2)
      RETURN
   90 PRINT 91
   91 FORMAT (1BLANK SCALE CARD - CHECK DECK*)
      STOP
      END
```

```
C
C**********************
C
      SUBROUTINE READATA(ISTOP,NTAXA)
C  SUBROUTINE TO READ DATA DECK AND CHECK FOR SEQUENCE ERRORS
C   END OF DATA DECK IS SIGNALED BY BLANK DATA TYPE
      COMMON L,YBOT,D(120),X(120),C(120,96)
      COMMON /D/ ITY,ITYPE
      COMMON /N/ IDUM(120),IDEPTH,NAME(120),DEPTH(120),SITE,DINT
      DIMENSION NV(5)
      DATA NV/16,8,2,16,11/
C
      NVAL=NV(ITY)
      L=0
C   BEGIN NEW SAMPLE OR LEVEL
  100 L=L+1
      J=NC=1
      LAST=NTAXA/NVAL
      IF (LAST*NVAL.NE.NTAXA) LAST=LAST+1
C   READ A CARD
  110 K=MIN0(J+NVAL-1,NTAXA)
      GO TO (120,140,140,160,170)ITY
C   RELATIVE
  120 READ 121,SITE,DEPTH(L),IA,IC,(C(L,I),I=J,K)
  121 FORMAT (A5,A4,R1,3X,I1,16F4.0)
      GO TO 200
C   ABSOLUTE (INCLUDING SCAN)
  140 READ 141,SITE,DEPTH(L),IA,IC,(C(L,I),I=J,K)
  141 FORMAT (A5,A4,R1,3X,I1,8F8.0)
      GO TO 200
C   LIFEFORM
  160 READ 161,SITE,DEPTH(L),IA,IC,(C(L,I),I=J,K)
  161 FORMAT (A5,A4,R1,3X,I1,F3,F11,6F8.0/11X,6F4.1,2F5.3)
      GO TO 200
C   ECOLOGY
  170 READ 171,SITE,DEPTH(L),IA,IC,(C(L,I),I=J,K)
  171 FORMAT (A5,A4,R1,3X,I1,F3,F11,4F8.0,4F4.1,F5.3)
  200 CONTINUE
C  CHECK FOR END OF DATA
      IF (IA.EQ.1R ) GO TO 180
C  CHECK CARD SEQUENCE
      IF (IC.NE.NC) GO TO 940
C  CHECK DATA TYPE
      IF (IA.NE.ITYPE) GO TO 930
C  CHECK NUMBER OF SAMPLES
      IF (L.GT.300) GO TO 950
      J=J+NVAL
      NC=NC+1
      IF (K.LT.NTAXA) GO TO 110
      CALL LEVEL
      GO TO 100
C   END OF DATA
  180 L=L-1
      RETURN
C  ERROR MESSAGES
  930 PRINT 931,IA,ITYPE
  931 FORMAT (1H0,R1,* FOUND AMONG *,R1)
      STOP
  940 CONTINUE
      PRINT 941,IC,NC,DEPTH(L)
  941 FORMAT (*0CARD*,I2,* FOUND INSTEAD OF*,I2,5X,A4)
      GO TO 110
  950 PRINT 951,DEPTH(L-1)
  951 FORMAT (*0TOO MANY LEVELS - DIAGRAM WILL BE DRAWN
     .TO *,A4)
      ISTOP=1
      GO TO 180
      END
C
C**********************
```

```
C
      SUBROUTINE LEVEL
C   SUBROUTINE TO CHECK FOR DUMMY LEVELS AND GENERATE LABELS
C      FOR NON-DEPTH SAMPLES
      COMMON L
      COMMON /N/ IDUM(120),IDEPTH,NAME(120),DEPTH(120),SITE,DINT
      REAL NAME
C
      IF (IDEPTH.EQ.0) GO TO 50
C   DEPTH SAMPLES
      IF (DEPTH(L).EQ.1H ) GO TO 30
      DECODE(4,11,DEPTH(L)) DEPTH(L)
   11 FORMAT (F4.1)
      IDUM(L)=0
      RETURN
C  DUMMY LEVEL FOR DEPTH SAMPLES
   30 IDUM(L)=1
      DEPTH(L)=DEPTH(L-1)+DINT
      RETURN
   50 IF (DEPTH(L).NE.1H ) GO TO 70
C  DUMMY LEVEL FOR NON-DEPTH SAMPLES
      NAME(L)=SITE
      IDUM(L)=1
      GO TO 80
C   NON-DEPTH SAMPLES
   70 NAME(L)=DEPTH(L)
      IDUM(L)=0
   80 DEPTH(L)=L-1
      RETURN
      END
C
C**********************
C
      SUBROUTINE VSCALE(NLET,DEPTH,DINT)
C   ROUTINE TO DETERMINE DEPTH OF PLOT (VERTICAL AXIS) AND SET THE ARRAY
C   D OF VERTICAL COORDINATE LOCATIONSFOR EACH SAMPLE
C   ARGUMENTS ARE NLET (NUMBER OF CHARACTERS TO BE PRINTED FROM NAME
C   CARDS, MAY BE AS LOW AS 20), DEPTH (THE ARRAY OF LEVEL DESIGNATORS
C   OR SAMPLE NUMBERS) AND DINT (THE INTERVAL BETWEEN LEVELS)
      DIMENSION DEPTH(120),YSCALE(3)
      COMMON L,YBOT,D(120)
      COMMON /N/ IDUM(120),IDEPTH,NAME(120)
      COMMON /Y/ YINT,ITRUNC,YSZERO,YSTRUNC
      DATA YSCALE/.5,.25,.175/
      DATA HIGHEST,LOWEST,GAPFROM,TO/8H HIGHEST,8H  LOWEST,8HGAP FROM,
     98H      TO/
C
      NINT=(DEPTH(L)-DEPTH(1))/DINT
      IGAP=NINT-L
      IYS=1
  190 YBOT = -NINT*YSCALE(IYS)
      IF (IGAP.GT.10) YBOT=-L*YSCALE(IYS)
      IF (YBOT.GE.-22.) GO TO 200
      IYS=IYS+1
      IF (IYS.GT.3) 960,190
  200 CONTINUE
      YINT=YSCALE(IYS)
      HOLE=10.*YINT
      YSCL=YINT/DINT
      D(1)=0.
      IF (IDEPTH.NE.0) GO TO 300
C   NON-DEPTH SAMPLES
      DO 230 I=2,L
      D(I)=-DEPTH(I)*YSCL
  230 CONTINUE
      PRINT 231
  231 FORMAT (*0 LIST OF SAMPLES*)
      PRINT 232,(NAME(I),DEPTH(I),D(I),I=1,L)
  232 FORMAT (5X,A10,F4.0,F8.2)
```

```
      GO TO 400
C   DEPTH SAMPLES
  300 PRINT 301,DINT,YINT
  301 FORMAT (*0FOSSIL SEDIMENT PROFILE:*/
     .*0INTERVAL IS*,F6.1,* CM   PLOTTED AS*,F6.2,* INCHES*)
      DZERO=DEPTH(1)
      PRINT 302,HIGHEST,DZERO,D(1)
  302 FORMAT (1H0,A9,*LEVEL*,F6.1,* CM PLOTTED AT*,F6.2,* INCHES*)
      DO 360 I=2,L
      D(I)=(DZERO-DEPTH(I))*YSCL
      DIFF=D(I-1)-D(I)
      IF (DIFF) 310,320,330
C  CHECK FOR 4TH SAMPLE AT SAME LEVEL OR 2 CONSECUTIVE GROUPS OF THREE
  310 IF (DEPTH(I).NE.DEPTH(I-1)) GO TO 970
C  DUPLICATE LEVELS ARE PLOTTED AT HALF-INTERVALS
  320 D(I)=D(I-1)-YINT*.5
      GO TO 360
  330 IF (DIFF.LE.YINT+.001) GO TO 360
C  CHECK FOR GAPS OF 10 OR MORE LEVELS
      IF (DIFF.LT.HOLE) GO TO 340
C  REDUCE GAP TO ONE INTERVAL
      D(I)=D(I)+DIFF-YINT
      DZERO=DZERO+DEPTH(I)-DEPTH(I-1)-DINT
  340 IF (IDUM(I-1).EQ.1) GO TO 350
C   DUMMY LEVEL ABSENT
      PRINT 302,GAPFROM,DEPTH(I-1),D(I-1),TO,DEPTH(I),D(I)
      GO TO 360
C   DUMMY LEVEL PRESENT
  350 PRINT 302,GAPFROM,DEPTH(I-2),D(I-2),TO,DEPTH(I),D(I)
  360 CONTINUE
      PRINT 302,LOWEST,DEPTH(L),D(L)
  400 CONTINUE
C  SET VERTICAL AXIS VALUES
      YBOT=D(L)
      YSTRUNC=YINT*.4
      YSZERO=YINT*.6
C  CALCULATE NUMBER OF CHARACTERS TO BE PRINTED
      NLET=(24.3+YBOT)*7.85
      NLET=MIN0(NLET,80)
      PRINT 401,NLET
  401 FORMAT (1H0,I2,* LETTERS OF TAXON NAME WILL BE DRAWN*)
      RETURN
C  ERROR MESSAGES
  960 PRINT 961,DEPTH(L),DINT,NINT
  961 FORMAT (*0LOWEST LEVEL IS*,F6.1,* CM., INTERVAL WIDTH IS*F6.1,
     .* NUMBER OF LEVELS IS*,I4/*0DIAGRAM IS TOO DEEP FOR PAPER*)
      STOP
  970 PRINT 971,DEPTH(I-1)
  971 FORMAT (*0TOO MANY SAMPLES CLUSTERED AT A DEPTH OF*,F6.1)
      STOP
       END
C
C**********************
C
      SUBROUTINE YAXIS
C   SUBROUTINE TO DRAW DEPTH SCALE
C   FO- NON-DEPTH SAMPLES, LOCATIONS ARE LABELED AND DUMMY
C     LEVELS ARE LABELED WITH SITE NAMES
      COMMON L,YBOT,D(120)
      COMMON /N/ IDUM(120),IDEPTH,NAME(120),DEPTH(120),SITE,DINT
      COMMON/T/TL
      COMMON /Y/ YINT
      DATA H,W/.14,.12/,HALF/.07/
C
C  BEGIN NEW SECTION WITH 3-INCH GAP
      CALL NEWORIG(3.0)
      TL=0.
      IF (IDEPTH.EQ.0) GO TO 400
C  DRAW BOX
      CALL BOX(1.2,YBOT)
```

```
C  BEGIN DEPTH SCALE
      CALL SYMBOL(1.52,1.2*H,H,3HCM.,0.,3)
      CALL SYMBOL(1.4,2.5*H,H,5HDEPTH,0.,5)
C  LOOP OVER NO. OF SAMPLES
      DO 320 I=1,L
      IF (IDUM(I).EQ.1) GO TO 320
      TICK=1.28
      LABY=DEPTH(I)
      Y=D(I)
C  LABEL ONLY THOSE LEVELS WHOSE DEPTHS ARE MULTIPLES OF 10
      IF (MOD(LABY,10).NE.0) GO TO 310
C  FIND NO. OF DIGITS IN LABEL
      K=KU(LABY,10)
      IF (K.GE.0) GO TO 300
C  ERROR PRINT
      PRINT 299,LABY,DEPTH(I),I,DEPTH(1)
  299 FORMAT (022,F7.1,I3,F7.1)
      K=0
C  CALCULATE STARTING LOCATION FOR NUMBER
  300 XX=1.32+W*(2-K)
      CALL NUMBER(XX,Y-HALF,H,DEPTH(I),0.,-1)
C  RESET TICK LENGTH
      TICK=1.35
C  DRAW TICK MARK
  310 CALL PLOT(1.2,Y,3)
      CALL PLOT(TICK,Y,2)
C  INCREMENT LABEL
  320 Y=Y-YINT
C  BOX AND DEPTH SCALE ARE 2.2 INCHES WIDE
      CALL NEWORIG(2.2)
      PRINT 321
  321 FORMAT (* DEPTH SCALE DRAWN HERE*)
      RETURN
C
C  BEGIN LABELING FOR NON-DEPTH SAMPLES
  400 Y=0.
C  LOOP OVER NUMBER OF LOCATIONS (INCLUDING DUMMY LOCATIONS)
      DO 440 I=1,L
      IF (IDUM(I).EQ.1) GO TO 420
C  DRAW TICK MARK AND LABEL LOCATION
      CALL PLOT(0.0,Y,3)
      CALL PLOT(0.08,Y,2)
      CALL SYMBOL(0.12,Y-HALF,H,NAME(I),0.,4)
      GO TO 440
C  FOR DUMMY LOCATIONS LABEL WITH SITE NAME + LOCATION
C  (I.E. SITE MAY BE SPECIFIED WITH UP TO 9 CHARACTERS)
  420 CALL SYMBOL(0.12,Y-HALF,H,4HSITE,0.,4)
      CALL SYMBOL(0.70,Y-HALF,H,NAME(I),0.,4)
  440 Y=Y-YINT
C  LABELING FOR NON-DEPTH SAMPLES IS 1 INCH WIDE
      CALL NEWORIG(1.0)
      PRINT 441
  441 FORMAT (*0SITE NAMES DRAWN HERE*)
      RETURN
      END
C
C**********************
C
      SUBROUTINE NEWORIG(X)
C   SUBROUTINE TO SET NEW (0,0) POINT ON CALCOMP PLOTTER
C   ORIGIN IS MOVED TO RIGHT BY X INCHES AND TL IS
C      INCREMENTED BY THE SAME AMOUNT
      COMMON L,YBOT
      COMMON /T/ TL
      EQUIVALENCE (Y,YBOT)
C
      TL=TL+X
      CALL PORGN(X,0.)
      RETURN
C
```

```
C    ENTRY POINT BOX DRAWS A BOX X INCHES WIDE BY THE ENTIRE
C       DEPTH OF THE DIAGRAM
C
       ENTRY BOX
       CALL PLOT(0.,0.,3)
       CALL PLOT(0.,Y,2)
       CALL PLOT(X,Y,2)
       CALL PLOT(X,0.,2)
       CALL PLOT(0.,0.,2)
       RETURN
       END
C
C*****M***************
C
       FUNCTION KU(NX,NU)
C    INTEGER FUNCTION TO FIND POWER OF NU LESS THAN OR EQUAL TO X
C
       NN=NU
       DO 20 I=1,8
       IF (NX/NN.EQ.0) GO TO 30
   20  NN=NN*NU
       PRINT 21,NX
   21  FORMAT (*1LARGE NUMBER FOR SCALE*,I15)
       I=0
   30  KU=I-1
       RETURN
       END
C
C*********************
C
       SUBROUTINE TRUNC(I,LZ,KZ,J)
C    SUBROUTINE TO DRAW TRUNCATED BAR AND CONNECT IT TO
C       ADJACENT BARS
       COMMON L,YBOT,D(120),X(120),C(120,96)
       COMMON /N/ IDUM(120),IDEPTH
       COMMON /Y/ YINT,ITRUNC,YSZERO,YSTRUNC
C
       IF (KZ.EQ.1) GO TO 10
       IF (LZ.EQ.1) GO TO 20
       IF (IDEPTH.EQ.0.AND. IDUM(I-1).EQ.1) GO TO 20
C   START FROM ZERO
       CALL PLOT(0.,D(I)+YSZERO,3)
       GO TO 30
C   CONNECT INTERIM POINTS
   10  CONTINUE
       CALL CONNECT(X(LZ),D(LZ),I   ,LZ)
       CALL PLOT(X(I-1),D(I-1),3)
       GO TO 30
C   START TRUNCATION AT TOP OF GRAPH
   20  CALL PLOT(X(I),D(I),3)
C    CONNECT ACROSS TRUNCATED BAR
   30  CALL PLOT(X(I),D(I)+YSTRUNC,2)
       CALL PLOT(X(I),D(I)-YSTRUNC,2)
       LZ=I+1
       IF (I.EQ.L) GO TO 60
       IF (C(LZ,J).LE.0) GO TO 50
       ITRUNC=2
       KZ=1
       RETURN
C    NEXT VALUE ZERO - CONNECT TO ORIGIN
   50  CALL PLOT(0.,D(I)-YSZERO,2)
   60  ITRUNC=0
       KZ=0
       RETURN
       END
C
C*********************
C
       SUBROUTINE CONNECT(X,D,LAST,FIRST)
C    SUBROUTINE TO CONNECT ENDS OF BARS
```

```
      COMMON L
      COMMON /Y/ YINT,ITRUNC,YSZERO,YSTRUNC
      COMMON /N/ IDUM(120),IDEPTH
      DIMENSION X(1),D(1)
      INTEGER FIRST
C
      N=LAST-FIRST
      IF (ITRUNC.LT.2) GO TO 5
C   START FROM TRUNCATED BAR
      ITRUNC=ITRUNC-2
      I=0
      CALL PLOT(X(I),D(I)-YSTRUNC,3)
      GO TO 10
    5 CONTINUE
      IF (FIRST.EQ.1) GO TO 20
      IF (IDUM(FIRST-1).EQ.1.AND.IDEPTH.EQ.0) GO TO 20
C   START FROM ORIGIN
      CALL PLOT(0.,D(1)+YSZERO,3)
C   DRAW TO BEGINNING OF BARS TO BE CONNECTED
   10 CALL PLOT(X(1),D(1),2)
   20 IF (N.LE.0) RETURN
C   CONNECT ALL BARS IN GROUP
      CALL LINE(X,D,N,1)
      IF (ITRUNC.EQ.1) RETURN
      IF (LAST.GT.L) RETURN
      IF (IDUM(LAST).EQ.1.AND.IDEPTH.EQ.0) RETURN
C   DRAW TO ORIGIN IF LAST BAR IS NOT TRUNCATION, DUMMY, OR LOWEST LEVEL
      CALL PLOT(X(N),D(N),3)
      CALL PLOT(0.,D(N)-YSZERO,2)
      RETURN
      END
C
C**********************
C
      SUBROUTINE DRAWSCL(XMAX,XTICK,XLAB,LABINC,NTAX)
C   SUBROUTINE TO DRAW SCALES AT TOP OF DIAGRAM
C     IF MAXIMUM WIDTH FOR THIS TAXON IS LESS THAN XTICK,
C         NO SCALE IS DRAWN
C     IF MAXIMUM WIDTH IS GREATER THAN XTICK BUT LESS THAN
C        XLAB,LABEL IS DRAWN AT XTICK
C     OTHERWISE, SCALE IS LABELED AT MULTIPLES OF XLAB AND
C        TICK MARKS ARE DRAWN AT MULTIPLES OF XTICK
      COMMON L
      COMMON /D/ ITY
      DIMENSION XX(3),JARL(16),JARE(11)
      DATA JARL/1,7*2,8*1/,JARE/1,5*2,5*1/
      DATA XX/-3.,.5,1.5/
      REAL LUNIT
      DATA H,W/.14,.12/
C
      IAR=ITY
      NTHOU=0
      IF (IAR.EQ.3) IAR=2
      IF (IAR.LT.4) GO TO 1
C  FOR LIFE FORM AND ECOLOGY DETERMINE WHETHER ITEM VALUES ARE
C   SMALL (IAR=1) OR LARGE (IAR=2)
      IF (ITY.EQ.4) IAR=JARL(NTAX)
      IF (ITY.EQ.5) IAR=JARE(NTAX)
    1 CONTINUE
      TUNIT=XTICK
      IF (XMAX.GE.XLAB) GO TO 10
      IF (XMAX.LT.XTICK) RETURN
      NUM=LABINC/2
      LUNIT=XTICK
      GO TO 20
   10 LUNIT=XLAB
      NUM=LABINC
   20 CONTINUE
      Y=.25
```

```
      YS=Y+.18
      NUMB=0
      NUMM=NUM
      IF (IAR.EQ.1) GO TO 30
C    FIND NUMBER OF COMMAS NEEDED FOR LARGE NUMBERS
      NTHOU=KU(NUM,1000)
      IF (NTHOU.GE.0) GO TO 25
      PRINT 24,NUM,LABINC,XMAX
   24 FORMAT (D22,I10,F10.1)
      NTHOU=0
   25 CONTINUE
      NUMM=NUM*.001**NTHOU
C    DRAW HORIZONTAL LINE
   30 CALL PLOT(XMAX,Y,3)
      CALL PLOT(0.,Y,2)
      XL=LUNIT
      X=0.
   40 IF (X.GT.XMAX) GO TO 100
      TICK=Y+.08
      IF (XL-X.GT..01) GO TO 80
C    LABEL TO BE DRAWN
      XN=X+XX(NTHOU+1)*W
      IF (NTHOU.EQ.0) GO TO 70
C    DRAW ZEROS AND COMMAS AS NEEDED
      DO 60 I=1,NTHOU
      CALL SYMBOL(XN,YS,H,4H,000,0.,4)
   60 XN=XN-4.*W
C    DRAW LEFTMOST PORTION OF NUMBER
   70 NUMB=NUMB+NUMM
      IF (NUMB.GE.10000) PRINT 71,NUMM,NUMB,LABINC
   71 FORMAT(*0NUMB GE 10000*,3I10)
      CALL NUMBER(XN,YS,H,NUMB,0.,2HI4)
      XL=XL+LUNIT
      TICK=Y+.15
C    DRAW TICK MARK
   80 CONTINUE
      CALL PLOT(X,Y,3)
      CALL PLOT(X,TICK,2)
   90 X=X+TUNIT
      GO TO 40
  100 IF (IAR.EQ.2) RETURN
      IF (ITY.GT.3.AND.NTAX.EQ.1) RETURN
C    DRAW PERCENT SIGN
      X=X-TUNIT+W
      CALL SYMBOL(X,YS,H,0,0.,1)
      RETURN
      END
C
C**********************
C
      SUBROUTINE EXOTICS
C    SUBROUTINE TO PLOT SUMMARY (IF ANY)
C      +OR RELATIVE, 3 GROUPS ARE EXPECTED
C         UNIT IS PERCENT
C         PLOT IS 1.4 INCHES WIDE
C      FOR ABSOLUTE, 1 GROUP IS EXPECTED
C         UNIT IS NUMBER OF GRAINS
C         PLOT IS SCALED, WIDTH IS VARIABLE
C      FOR ALL OTHER TYPES, NO SUMMARY IS DONE
      COMMON L,YBOT,D(120),X(120),C(120,96),XSUM(4,120),GNAME(3)
      COMMON /D/ ITY
      COMMON /N/ IDUM(120),IDEPTH,NAME(120),DEPTH(120)
      COMMON /S/ SCLFACT(8),XTICK(8),XLAB(8),LABINC(8),
     .CUTOFF(8),NSC(97),NSX
      DIMENSION LINE(41)
      DATA NL/0/
C
C  NO SUMMARY EXCEPT FOR RELATIVE OR ABSOLUTE
      IF (ITY.GT.2) RETURN
      IF (ITY.EQ.1) GO TO 10
```

```
C  ABSOLUTE ---
C  SET SCALE INFORMATION AND NUMBER OF GROUPS FOR EXOTICS
      XSCALE=SCLFACT(NSX)
      LAB=LABINC(NSX)
      XLABL=XLAB(NSX)
      XTICKS=XTICK(NSX)
      GNAME(1)=7HEXOTICS
      M=1
      GO TO 20
C  RELATIVE ---
C  SET SCALE INFORMATION AND NUMBER OF GROUPS FOR PERCENT TABLE
   10 CONTINUE
      M=3
      XSCALE=1.4
      XTICKS=.35
      XLABL=.7
      LAB=50
C   ZERO ARRAYS
   20 CONTINUE
      DO 400 I=1,L
  400 X(I)=0.
      XMAX=0.
      TX=0.
C   PRINT HEADING
      PRINT 408,(GNAME(I),I=1,M)
  408 FORMAT (*0SUMMARY*/*0 LEVEL*,3A11)
      CALL NEWORIG(.5)
C   BEGIN LOOP OVER NUMBER OF CATEGORIES
      DO 430 I=1,M
      LZ=1
      IF (IDUM.EQ.1) LZ=2
      DO 420 J=1,L
      IF (IDUM(J).EQ.0) GO TO 405
C   DUMMY LEVEL
      IF (J.EQ.1) GO TO 404
      CALL CONNECT(X(LZ),D(LZ),J,LZ,0)
      LZ=J+1
      IF (IDEPTH.EQ.1) GO TO 420
      IF (I.GT.1) GO TO 420
      NL=NL+1
      IF (NL.GT.41) GOTO 940
      LINE(NL)=J-1
  404 CONTINUE
      IF (I.GT.1) GO TO 420
      NL=NL+1
      LINE(NL)=J+1
      GO TO 420
C   DATA VALUE
  405 CONTINUE
      TEMP=XSUM(I,J)
      IF (TEMP.EQ.0.) GO TO 420
      TX=TX+TEMP
      IF (M.EQ.3) GO TO 410
C   EXOTICS ONLY - SCALE VALUES
      X(J)=TEMP*XSCALE
      IF (X(J).GT.XMAX) XMAX=X(J)
      GO TO 420
  410 CONTINUE
C   PERCENTAGES ONLY - SUM ACROSS GROUPS
      TEMP=TEMP/XSUM(4,J)
      X(J)=TEMP*XSCALE + X(J)
      XSUM(I,J)=TEMP*100.
  420 CONTINUE
      IF (TX.EQ.0) GO TO 490
      CALL CONNECT(X(LZ),D(LZ),L+1,LZ,0)
  430 CONTINUE
C   END OF LOOP OVER NUMBER OF CATEGORIES
C   PRINT VALUES
      DO 440 J=1,L
      PRINT 431,DEPTH(J),(XSUM(I,J),I=1,M)
```

```
  431 FORMAT (F6.1,X,3F11.1)
C   ENCLOSE IN BOX
  440 CONTINUE
      IF (M.EQ.3) XMAX=1.4
      CALL BOX(XMAX,YBOT)
C   DRAW NAMES AT BOTTOM
      XX=0.
      YY=YBOT-.2
      DO 450 I=1,M
      CALL SYMBOL(XX,YY,.14,GNAME(I),315.,10)
  450 XX=XX+.6
      PRINT 452,XMAX
  452 FORMAT (*0LENGTH=*,F4.2)
      CALL DRAWSCL(XMAX,XTICKS,XLABL,LAB)
C   SEPARATE SECTIONS FOR DUMMY LEVELS
      IF (NL.EQ.0) GO TO 480
      DO 460 I=1,NL
      J=LINE(I)
      CALL PLOT(0.,D(J),3)
      CALL PLOT(XMAX,D(J),2)
  460 CONTINUE
      NL=0
C   MOVE TO END OF SECTION
  480 CALL NEWORIG(XMAX)
      RETURN
  490 PRINT 491
  491 FORMAT (*0NO DATA*)
      RETURN
  940 PRINT 941,I,J,LZ
  941 FORMAT (*0WARNING --- TOO MANY BREAKS*,3I5)
      GO TO 420
      END
```

6.0 LEGEND

Stratigraphy and labeling are not a part of the pollen diagram produced by DISPLAY; these must be added to the CALCOMP drawing. The stratigraphy must be done by hand; however, all lettering and labeling may be done by a small program which draws the needed items to a specified size, using the same character set as the rest of the diagram. These are then cut and pasted onto the diagram as needed, reducing drafting time and ensuring consistency of lettering. Figure 6.1 is an example of the plotted output.

The program, called LEGEND, is short and simple to use. The input to the program consists of cards with the following format:

Data Field (Card Columns)	Contents of Field
1	Character size, can be 1 through 9
3-22	Label to be drawn

Actual height of the characters is .07 times the character size in column 1, i.e., a range of .07 to .63 inches. The most commonly used sizes are 2 (.14 inches) and 3 (.21 inches). Figures 6.2 and 6.3 show the card input and printed output.

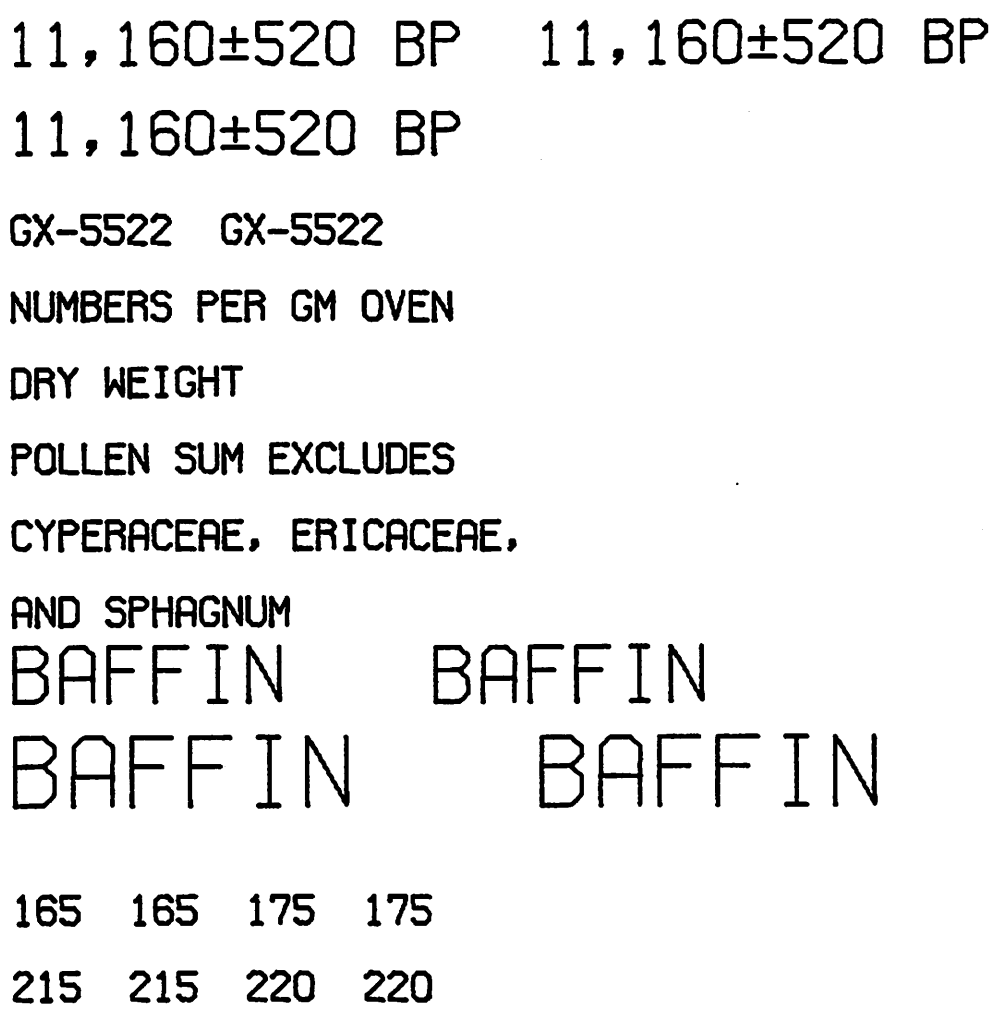


Figure 6.1. Plotter output from LEGEND.

```
CARD COLUMN:
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

3 11,160\520 BP  11,160\520 BP
3 11,160\520 BP
2 GX-5522  GX-5522
2 NUMBERS PER GM OVEN
2 DRY WEIGHT
2 POLLEN SUM EXCLUDES
2 CYPERACEAE, ERICACEAE,
2 AND SPHAGNUM
4 BAFFIN   BAFFIN
5 BAFFIN   BAFFIN
2 165  165  175  175
2 215  215  220  220

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

Figure 6.2. Card input to LEGEND.

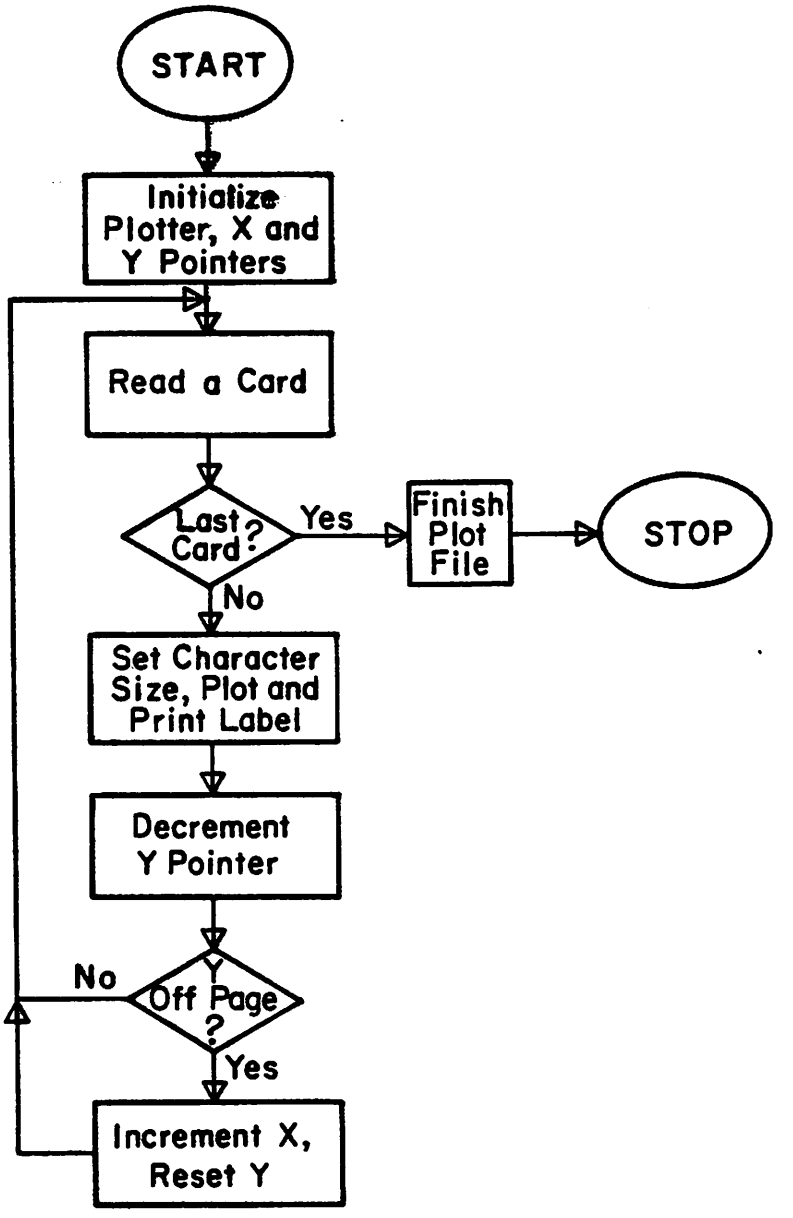
```
THE FOLLOWING WERE WRITTEN ON CALCOMP
(NOTE: \ WILL BE PLOTTED AS A PLUS-OR-MINUS SIGN)
CHARACTER HEIGHT IS GIVEN IN INCHES
11,160\520 BP  11,160\520 BP     .21
11,160\520 BP                    .21
GX-5522  GX-5522                 .14
NUMBERS PER GM OVEN              .14
DRY WEIGHT                       .14
POLLEN SUM EXCLUDES              .14
CYPERACEAE, ERICACEAE,           .14
AND SPHAGNUM                     .14
BAFFIN   BAFFIN                  .28
BAFFIN   BAFFIN                  .35
165  165  175  175               .14
215  215  220  220               .14
```

Figure 6.3. Printed output from LEGEND.

Program Listing for LEGEND

```
C     LEGEND
C
C    WRITES LABELS NECESSARY TO COMPLETE DISPLAY DIAGRAM
C     ON CALCOMP PLOTTER
C
C    DEVELOPED IN 1975 BY MARGARET M. ECCLES
C    UNDER THE DIRECTION OF MARGARET HICKEY
C
C    CHARACTER SIZES ARE IN INCREMENTS OF .07 INCHES
C   INPUT DECK CONSISTS OF CARDS IN THE FOLLOWING FORMAT:
C      COL. 1       INTEGER NUMBER INDICATING SIZE OF CHARACTER
C                      (HEIGHT IS NUMBER TIMES .07 INCHES)
C      COLS.3 - 32 LABEL
C    REPEAT FOR AS MANY LABELS AS DESIRED
C
       PROGRAM LEGEND(INPUT,OUTPUT,PLOT,TAPE4=PLOT,TAPE5=INPUT)
       DIMENSION L(3)
       PRINT 1
     1 FORMAT (*1THE FOLLOWING WERE WRITTEN ON CALCOMP*/
      .    *0(NOTE:   WILL BE PLOTTED AS A PLUS-OR-MINUS SIGN)*/
      .   *0CHARACTER HEIGHT IS GIVEN IN INCHES*)
C    INITIALIZE X AND Y FOR LOCATION OF LABEL ON PAGE
       X=1.
       Y=28.
       CALL PSTART(1,4)
C    READ CHARACTER SIZE AND LABEL
    10 READ 11,J,L
    11 FORMAT (I1,X,3A10)
       IF (EOF,5) 90,20
C    CONVERT CHARACTER SIZE TO INCHES
    20 H=J*.07
C    PLOT LABEL
       CALL SYMBOL(X,Y,H,L,0.,30)
C    DECREMENT Y FOR NEXT LABEL
       Y=Y-H-.25
C    PRINT LABEL
       PRINT 21,L,H
    21 FORMAT (1H0,3A10,F5.2)
       IF (Y.GT.0.) GO TO 10
C    BOTTOM OF PAGE --- START A NEW COLUMN
       X=X+8.
       Y=28.
       GO TO 10
C    END OF RUN
    90 CALL PEND(5.)
       STOP
       END
```

FLOW CHART FOR LEGEND



7.0 DGTIZR

The digitizer briefly used by this laboratory was an old one, a Bensen-Lehner Oscar-K; the DGTIZR program was not developed beyond a preliminary rough version in the short time that the digitizer was in use. An extended period during which no digitizer was readily available precluded the development of any other program to replace it. The number of diagrams that were actually digitized was quite small, and the program includes a number of assumptions that would have been made more generally applicable had a wider variety of diagrams been digitized. This program is included in this report more to demonstrate the feasibility of such a process than to provide a program which is expected to be usable as it stands.

7.1 Characteristics of the Digitization Process

All the diagrams digitized were fossil sediment profiles with two scales, one of which was ten times larger than the other. Since the digitization processed required drawing a template for each different scale, it proved convenient to digitize all those taxa using the smaller full-scale value and number them in sequence, and then to change templates and continue the sequence for those taxa requiring the larger full-scale value.

Values produced by the digitizer are in the range 000 to 999, where 000 represents a minimum value and 999 a maximum value. These are converted to counts or percentages by the formula C = (X-XMIN)/XMAX x FS, where C is the count or percentage, X is the value output by the digitizer read as thousandths, XMIN and XMAX are minimum and maximum digitizer readings, and FS is the count or percentage value corresponding to the maximum value.

7.2 Output From the Program

The primary output from the DGTIZR program is the cards; printed output is little more than a listing of the same information arranged to facilitate checking the results.

The format of the punched output is compatible with punched output from POLDATA, as follows:

Data Field (Card Columns)	Contents of Field
1-5	Site identification
6-9	Level designation
10	Data type indicator (A or R)
11-13	Blank
14	Card number
15-80	8 values in 8-column fields (absolute) or 16 values in 4-column fields (relative)

Figure 7.1 shows a listing of these cards.

Printed output begins with a listing of the input parameters and taxon names. The derived values are listed in table form, 26 to a line for relative data and 14 to a line for absolute data. Taxon names are shortened accordingly, to 5 characters for relative and 9 for absolute. Figure 7.2 gives an example of the absolute format.

7.3 Card Input

Information about the dimensions of the profile and site identification are provided in the first card:

Data Field (Card Columns)	Contents of Field
1-5	Site name
9-10	Number of taxa
13-15	Number of levels
17-20	Depth of first (highest) level in mm
23-25	Interval between levels in mm

The scale is specified on another card, as follows:

Data Field (Card Columns)	Contents of Field
1-5	Minimum digitizer reading (usually zero)
6-10	Maximum digitizer reading (not always 999)
11-20	Full scale value represented by maximum reading
24-25	Input sequence number of first taxon requiring larger full scale value

Because of the altered sequence of taxa, final sequence numbers must be included with the names. The format is:

Data Field (Card Columns)	Contents of Field
2-3	Final sequence number
6-14	Taxon name

The data type is specified on a separate card; the character in column 1 is used to identify the data type in the card output.

Data cards complete the setup. The format is as follows:

Data Field (Card Columns)	Contents of Field
1-2	Deck identification
3-4	Input sequence number (references a position in the list of taxon names)
5	Card number
6-8	Value for first level
9-11	Value for second level
...	...
78-80	Value for 25th level

Additional levels are continued on succeeding cards in the same format, for as many cards as needed. These are repeated for each taxon.

Figure 7.3 shows a sample listing of input cards.

```
CARD COLUMN:
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

CODLK    0A   1      -0    4395      -0    4395    19779      -0      -0   26372
CODLK    0A   2    4395
CODLK   50A   1    2857    6593      -0   17581    85710      -0      -0   10988
CODLK   50A   2   10988
CODLK  100A   1    2857   17581      -0   10988    74721     879      -0   26372
CODLK  100A   2   28570
CODLK  150A   1     440    4395      -0    4395    35163      -0      -0    4395
CODLK  150A   2   15384
CODLK  200A   1      -0   10988      -0   13186   191199      -0      -0   52744
CODLK  200A   2   85710
CODLK  250A   1      -0   41756    1758   50547   169222      -0      -0   79117
CODLK  250A   2   81314
CODLK  300A   1    2857   41756      -0   41756   226362      -0      -0   81314
CODLK  300A   2   83512
CODLK  350A   1      -0   24175      -0   48349   254932      -0      -0  107687
CODLK  350A   2   85710
CODLK  400A   1    4835   92303      -0   48349   406572      -0      -0  274711
CODLK  400A   2  149443

         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

Figure 7.1. Punched output from DGTIZR.

	ABIES	ALNUS	BETULA	PICEA	PINUS	PSEUDOT	SUSALIX	THUJA	TSUGA
0.0	-0	4395	-0	4395	19779	-0	-0	26372	4395
5.0	2857	6593	-0	17581	85710	-0	-0	10988	10988
10.0	2857	17581	-0	10988	74721	879	-0	26372	28570
15.0	440	4395	-0	4395	35163	-0	-0	4395	15384
20.0	-0	10988	-0	13186	191199	-0	-0	52744	85710
25.0	-0	41756	1758	50547	169222	-0	-0	79117	81314
30.0	2857	41756	-0	41756	226362	-0	-0	81314	83512
35.0	-0	24175	-0	48349	254932	-0	-0	107687	85710
40.0	4835	92303	-0	48349	406572	-0	-0	274711	149443
45.0	14065	114280	-0	41756	705457	-0	25054	641725	193396
50.0	1758	149443	-0	74721	577992	440	-0	503270	248339
55.0	-0	193396	5274	32965	426351	-0	-0	421956	156036
60.0	9450	219769	-0	131861	1070273	-0	9450	745016	259327
65.0	7252	96698	-0	70326	670294	-0	-0	481293	186803
70.0	-0	134059	4835	39558	448328	4615	-0	413165	173617
75.0	-0	79117	-0	48349	538433	-0	-0	360421	283502
80.0	4176	70326	-0	63733	349432	6373	-0	268118	136257
85.0	12307	125268	-0	156036	654911	18021	-0	514259	219769
90.0	11208	215373	-0	79117	378002	6373	6373	403712	342839
95.0	16263	74721	6154	61535	729632	20438	-0	342839	228559
100.0	-0	283502	-0	140652	650515	-0	-0	727434	360421
105.0	9011	151640	-0	81314	883470	-0	-0	883470	178013
110.0	-0	349432	-0	118675	206583	12307	-0	602166	250536
115.0	-0	514259	1648	428549	441735	-0	-0	934017	580189
120.0	-0	1997697	-0	599968	657108	19340	19559	953796	999947
125.0	-0	619748	-0	279106	147245	-0	-0	171420	309874
130.0	-0	367014	-0	59338	70326	-0	-0	48349	180210
135.0	-0	850505	-0	369211	136257	8351	7912	79117	468107
140.0	-0	413165	-0	235152	79117	7692	-0	26372	202187
145.0	4176	323060	4176	241746	85710	19120	-0	21977	217571
150.0	7472	804353	-0	386793	118675	18461	-0	39558	358223
155.0	-0	687876	5934	353828	63733	11428	-0	48349	303281
160.0	-0	604364	6373	309874	63733	-0	-0	52744	246141
165.0	-0	1028517	-0	452723	94501	-0	-0	30768	254932
170.0	-0	450526	4395	314269	96698	-0	-0	30768	101094
175.0	-0	984564	-0	371409	72524	-0	-0	37361	224164
180.0	-0	958191	-0	459317	74721	7912	-0	19779	193396
185.0	6813	742818	-0	364816	61535	-0	-0	37361	193396
190.0	-0	1010936	-0	468107	72524	-0	7692	17581	246141
195.0	-0	1382345	-0	575794	72524	-0	17362	-0	230757
200.0	-0	1030715	-0	419758	72524	-0	-0	4395	270315
205.0	8131	999947	-0	327455	85710	8351	-0	4395	345037
210.0	-0	1019727	-0	402177	76919	8571	-0	4395	470305
215.0	-0	1364763	-0	325258	17581	9890	-0	54942	393386
220.0	-0	1166972	-0	292292	54942	-0	8571	-0	421956
225.0	5934	740620	-0	167024	28570	-0	5714	28570	204385
230.0	-0	1008738	-0	167024	37361	-0	11208	-0	230757
235.0	-0	641725	-0	182408	26372	-0	-0	28570	367014
240.0	-0	696667	-0	274711	52744	5934	-0	-0	261525
245.0	-0	657108	-0	349432	39558	-0	12087	-0	479096
250.0	-0	826330	-0	481293	50547	-0	-0	4395	215373
255.0	7912	964784	-0	670294	68128	-0	-0	-0	90105
260.0	16922	1417508	-0	573596	32965	-0	16263	-0	114280
265.0	-0	969180	-0	189001	41756	6813	-0	35163	257129
270.0	-0	1421903	-0	142850	32965	-0	-0	28570	169222
275.0	-0	2090000	-0	206583	68128	-0	18461	17581	191199
280.0	-0	639527	-0	140652	171420	-0	23735	4395	325258
285.0	-0	604364	-0	81314	437340	-0	-0	28570	103291
290.0	-0	410967	-0	107687	501073	-0	12747	19779	92303
295.0	3077	305478	-0	24175	228559	-0	-0	4395	24175

Figure 7.2. Printed output from DGTIZR (absolute data).

```
CARD COLUMN:
        1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890


CODLK    9   64    0   50
   0  .951    209000    5
  1  ABIES
  3  BETULA
  6  PSEUDOTSUGA
  7  SALIX
  2  ALNUS
  4  PICEA
  5  PINUS
  8  THUJA
  9  TSUGA
ABSOLUTE
CL011   013013002      013   022064008   043033      019056051074   041
CL012            019034                 031          037          027
CL013   036077                    014012   010
CL021                008                    024      022             028          053
CL022            019   027029   020
CL023
CL031      004                        002          021   029082029093      056   088
CL032      038035087084052               036             038039045             027
CL033         031
CL041                                  114      043                029                089
CL042      036                                  035079             039026051      055
CL043      074      084108   058      011010018
CL0510020030080020050190190110420520680881000440610360320570980341290691592349090
CL0522821673871881473663132754682054484363384606294694554646215313374592923172990
CL0533764396454416479512912751871390790990761710
CL0610020080050020060230190220220190340150600320180220290710360280640370541952730
CL0621270271681071101761611412061431692091662132621911491831481330760760831251590
CL0632193052610860650940640370490110140270310890
CL0710090390340160870771031161853212631944873052042451592981723322964020942012990
CL0720670320620360390540290290430440330340280330330330390350080250130170120240180
CL0730230310150190150310781992281040520640430340
CL0810120050120020240360370491252922291923392191881641222342111563314022744254340
CL0820780220360120100180220240140140170090170080020020020250130
CL083002      0160130080020130090020020020050
CL0910020050130070390370380390680881130711180850791290621001561041640811142644550
CL0921410822130920991631381121160461020880881121051231572141791920931051671192180
CL0930980410521170770871480470420110090090020230


        1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

Figure 7.3. Card input to DGTIZR.

```
C     DGTIZR
C
C    PROGRAM TO CONVERT DIGITIZER OUTPUT TO POLDATA-COMPATIBLE OUTPUT
C
C    DEVELOPED IN 1975 BY MARGARET M. ECCLES
C    UNDER THE DIRECTION OF MARGARET HICKEY
C
C       CARD INPUT:
C    1) PARAMETER CARD
C       COLS.  1- 5  SITE NAME
C       COLS.  9-10  NUMBER OF TAXA
C       COLS. 13-15  NUMBER OF LEVELS
C       COLS. 17-20  DEPTH OF FIRST LEVEL IN MM.
C       COLS. 23-25  INTERVAL BETWEEN LEVELS
C    2) SCALE INFORMATION CARD
C       COLS.  1- 5  MINIMUM VALUE FROM DIGITIZER
C       COLS.  6-10  MAXIMUM VALUE FROM DIGITIZER
C       COLS. 11-20  FULL SCALE VALUE
C       COLS. 24-25  SEQUENCE NUMBER OF FIRST TAXON USING A FULL SCALE
C                    VALUE TEN TIMES AS LARGE AS PREVIOUS TAXA
C    3) TAXON NAME CARDS
C       COLS.  2- 3  TAXON NUMBER
C       COLS.  6-14  TAXON NAME
C    4) TYPE CARD (ABSOLUTE OR RELATIVE)
C    5) DATA CARDS
C       COLS.   1- 2  IDENTIFICATION (IGNORED BY PROGRAM)
C       COLS.  3- 4  TAXON SEQUENCE NUMBER
C       COL.      5  CARD NUMBER
C       COLS.  6- 8  VALUE FOR FIRST LEVEL
C       COLS.  9-11  VALUE FOR SECOND LEVEL
C                ...   ...
C       COLS. 78-80  VALUE FOR 25TH LEVEL
C       CONTINUED FOR AS MANY CARDS AS NEEDED PER TAXON.  BEGIN AGAIN
C       WITH CARD ONE FOR NEXT TAXON.  THERE MUST BE ONE SET OF CARDS FOR
C       EACH TAXON, AND EACH SET MUST CONTAIN DATA FOR THE NUMBER OF
C       LEVELS SPECIFIED.
C
      PROGRAM DGTIZR (INPUT,OUTPUT,PUNCH,TAPE5=INPUT)
      COMMON C(20,200)
      DIMENSION X(25), NAME(20), NOUT(20), FORM(2), PFORM(3)
      DIMENSION NC(2),IW(2)
      DATA FORM(1)/6H(F6.1,/
      DATA PFORM/10H(A5,I4,R1,, 6H3X,I1,, 1H /
      DATA NC,IW/8,16,8,4/
C
C     READ PARAMETER CARD
   10 READ 11,SITE,NTAXA,NLEVELS,LO,INC
   11 FORMAT(A5,4I5)
C     READ SCALE INFROMATION CARD
      READ 12,XMIN,XMAX,FULSCAL,LARGE
   12 FORMAT(2F5.3,F10.0,I5)
      PRINT 13,SITE,NTAXA,NLEVELS,LO,INC,XMIN,XMAX,FULSCAL
   13 FORMAT (1H1,A5,I5,5H TAXA,I5,* LEVELS BEGINNING AT*,I3,* MM AND IN
     .CREASING BY INTERVALS OF*,I3,* MM*/*0DIGITIZER MINIMUM READING =*,
     .F5.3,/11X,*MAXIMUM READING =*,F5.3/16X,*FULL SCALE =*,F10.0/)
C     READ TAXON NAMES
      DO 20 I=1,NTAXA
      READ 17,J,NAME(J)
   17 FORMAT(I3,2X,A9)
      NOUT(I)=J
   20 CONTINUE
      PRINT 17,(J,NAME(J),J=1,NTAXA)
```

```
C    READ DATA TYPE
       READ 21,ITYPE
    21 FORMAT(R1)
C     (ABSOULTE=1, RELATIVE=2)
       ITY=MIN0(ITYPE,2)
C    CREATE OUTPUT FORMAT FOR PUNCH
       ENCODE (7,253,PFORM(3)) NC(ITY),IW(ITY)
C    READ A DATA CARD
   100 READ 101,NT,J,X
   101 FORMAT(2X,I2,I1,25F3.3)
C    CHECK FOR END OF DATA
       IF(EOF,5)200,120
   120 IF(J.GT.1)GOTO130
C    FIRST CARD
       K=NOUT(NT)
       NTAX=NT
C    SCALE CHANGE
       IF (NT.EQ.LARGE) FULSCAL=FULSCAL*10.
       GO TO 140
C    SEQUENCE CHECK
   130 IF (NT.NE.NTAX) GO TO 910
C    FILL DATA MATRIX
   140 L=(J-1)*25+1
       M=MIN0(L+24,NLEVELS)
       J=0
       DO160I=L,M
       J=J+1
       IF(X(J).LT.0)GOTO150
       IF (SIGN(1.,X(J)).LT.0.) GO TO 160
C    SCALE VALUE
       X(J)=(X(J)-XMIN)/XMAX*FULSCAL
       GO TO 160
C    SCAN VALUE
   150 X(J)=-1.
   160 C(K,I)=X(J)
       GO TO 100
   200 IF(NTAX.NE.NTAXA)GOTO920
C    LOOP OVER LEVELS
       LEV=L0
       DO 250 L=1,NLEVELS
       K=0
       N=NC(ITY)
C    PUNCH CARDS FOR A LEVEL
       DO 220 I=1,NTAXA,N
       K=K+1
       J=MIN0(NTAXA,I+N-1)
       PUNCH PFORM,SITE,LEV,ITYPE,K,(C(M,L),M=I,J)
   220 CONTINUE
   250 LEV=LEV+INC
C    PREPARE FORMATS FOR PRINTED OUTPUT
       M=14+(ITY-1)*12
       J=9-(ITY-1)*4
       ENCODE(7,253,FORM(2))M,J
   253 FORMAT(I2,1HF,I1,3H.0))
       ENCODE (10,254,AFORM) M,J
   254 FORMAT (5H(10X,,I2,1HA,I1,1H))
C    LOOP OVER TAXA BY PAGE
       DO 280 I=1,NTAXA,M
       PRINT 255
   255 FORMAT (1H1)
       J=MIN0(NTAXA,I+M-1)
C    PRINT HEADING OF TAXON NAMES
       PRINT AFORM,(NAME(K),K=I,J)
       RLEV=L0*.1
       RINC=INC*.1
C    LOOP OVER LEVELS
       DO 270 L=1,NLEVELS
       PRINT FORM,RLEV,(C(K,L),K=I,J)
       RLEV=RLEV+RINC
```

```
  270 CONTINUE
  280 CONTINUE
      STOP
C   ERROR MESSAGES
  910 PRINT 911,NT,NTAX
  911 FORMAT (*1CARDS OUT OF ORDER*,2I3)
      STOP
  920 PRINT 921,NTAX,NTAXA
  921 FORMAT (*0*,I3,* TAXA READ IN.  SHOULD BE*,I3)
      STOP
      END
```

APPENDIX I

DICTIONARY OF VARIABLES FOR POLDATA

A - array used to hold coded values for scan "absolute" calculation, trap "absolute" per unit measurement calculation, and trap scan "absolute" per unit measurement calculation for each taxon, if these are present (MAIN); taxon names as read from a card (RNAMES); array filled with column headings (PRHEAD2).

ABS - the array of coded values for "absolute" counts per unit measurement for all taxa.

BIGA - treated sample weight (PRHEAD).

BLANK - a word containing nothing but blanks (PRHEAD2).

CODE - data type designation to be punched in card output (PPUNCH).

COUNT - array containing formats for card output (PPUNCH).

DEPTH - array containing formats to be used for card output (PPUNCH); depth of sample (PRHEAD).

EXCL - names selected on title card; counts associated with this name are not to be considered in total used to calculate percentages (MAIN, EXCLUDE).

EXC2 - overflow storage area for EXCL.

FLAG - character in column 10 of data card, specifying T, H, or S group (trees, herbs, spores) (RNAMES).

FN - array holding the codes T, H, S for comparison with name cards (RDATA, RNAMES).

FORM - array containing the basic format for card output (PPUNCH).

Note: Capitalized names in parentheses indicate routines where variable is used; no such designation indicates main program only.

G - size of original sample (MAIN, PRHEAD).

I - general index variable used in most routines.

IA - array containing alphabetic representation of cards read in (MAIN, RCARD, PRHEAD).

IC - card number; found in column 14 of data cards, used to specify second card if H group is too large to be accommodated on one card (MAIN, RNAMES, PPUNCH).

ID - flag for DEPTH converted to a subscript (PPUNCH).

IDEPTH - flag for selection of depth option (MAIN, PPUNCH, PRHEAD).

IDUM - dummy array used as a spacer in COMMON used in subroutines (NEWI, RNAMES, SETSPCN, EXCLUDE).

IFLAG - same as FN in R format (RCARD).

IFN - counter for name cards (RNAMES).

II - index used for items on each card of count data.

IN - counter for groups (T, H, and S) (MAIN, RNAMES).

IOPT - array of all three option flags: IPUNCH, IDEPTH, ITRAP (MAIN, RNAMES).

IORD - array containing reordered sequence of original numbers (NEWI/ NEWORD).

IPIC - order number of taxon PIC (Picea) (MAIN, SETSPCN).

IPIN - order number of taxon PIN (Pinus) (MAIN, SETSPCN).

IPOWER - power of microscope (PRHEAD).

IPUNCH - flag for selection of punch option (MAIN, NEWORD).

ISITE - another name for SITE (PRHEAD).

ISLIDE - size of slide (PRHEAD).

ISP - flag set if scan values for Picea and Pinus are present on level header card (MAIN, PRHEAD, PRHEAD2).

ITRACE - order number of taxon for added tracer (MAIN, RNAMES).

ITRAP - flag for selection of trap option (MAIN, PRHEAD, PRHEAD2).

IX - array of count values as read from data card.

IXC - flag set if there are any exclusions from total count MAIN, EXCLUDE).

IXCL - array of flags for exclusion of taxa from total count (MAIN, EXCLUDE).

J - number used by RCARD to specify kind of card read and group number for data cards (MAIN, RCARD); flag for selecting proper punch format (PPUNCH); index variable in many subroutines.

JJ - general index variable.

K - index and counter used to reference different count subtotals for a sample (MAIN); general index variable in many subroutines.

KK - array of entire set of counts for a sample.

KL - count subtotal as read from data card.

KMAX - number of different count subtotals for a sample (MAIN, PRHEAD2).

KNT - array of count subtotals as calculated by program.

KOUNT - array of count subtotals as read from cards (MAIN, PRHEAD2), maximum count to be punched in card output (PPUNCH).

L - index and counter used to reference different taxa; also used for indexing and referencing count total discrepancies (MAIN); general index variable in some subroutines.

LOC - site identification - generally an abbreviation of information on title card (RNAMES, PPUNCH).

MASK - mask to isolate rightmost character in a word (RCARD).

MIC - microscope identification (PRHEAD).

MISS - array of indices of count discrepancies.

N - variable specifying number of taxa (MAIN, NEWI/NEWORD, PPUNCH, EXCLUDE); used as a counter while reading name cards (RNAMES); coded percentage value (PERCENT).

NAME - site name as read from header card (PRHEAD).

NC - column number (PRHEAD2).

NM - first taxon number for taxa on a given data card.

NN - last taxon number for taxa on a given data card (MAIN); number of first taxon in S group (EXCLUDE).

NO - trap number or name (PRHEAD).

NOPT - array of words to check against cards for selection of option.

NORD - array of new taxon numbers in original sequence (NEWI/NEWORD).

NPUNCH - number of taxa after reordering.

NSP - order number of scan variable; always 1 for Picea, 2 for Pinus.

NW - array containing number of values per card for each type (PPUNCH).

N1 - array of first taxon number for each group (MAIN, RNAMES).

N2 - array of last taxon number for each group (MAIN, RNAMES).

P - array of coded percent values for highest count subtotal for all taxa.

PCT - array of coded percent values for all count subtotals for a given taxon.

PK - array of coded count values.

PNAME - array of taxon names (MAIN, RNAMES, NEWORD, SETSPCN, EXCLUDE).

PSCAN - designation of scan values used on punched output (PPUNCH).

PTYPE - peat type for single fossil samples (PPUNCH, PRHEAD).

RECOV - percentage recovery based on exotic tracer added.

SCAN - designation of scan values used on printed output (PPUNCH).

SITE - sample identification (PPUNCH, PRHEAD).

SMALLA - weight of slide (PRHEAD).

SP - value for scan count used for both Picea and Pinus.

SPIC - value for scan count for Picea (MAIN, PRHEAD).

SPIN - value for scan count for Pinus (MAIN, PRHEAD).

SPP - array of calculated "absolute" counts per unit measurement for Picea and Pinus.

TABS - calculated "absolute" counts per unit measurement for exotic tracer added without adjustment for percentage recovery.

TITLE - description of general location of samples, printed at the top of each page.

TMASK - masking value used to isolate the first letter of a word (RNAMES, PRHEAD).

TPG - calculated count for tracer added per unit measurement.

TRAP - array containing names of trap types (PRHEAD); a variable containing the word TRAP (PRHEAD2).

TRAV - number of traverses counted (PRHEAD).

TRORIG - total count of tracer added per sample (MAIN, PRHEAD).

TRVMX - number of possible traverses per slide (PRHEAD).

TYPE - peat type for single fossil samples (PRHEAD).

UNIT - label for units of measurement (MAIN, PRHEAD, PRHEAD2).

UTYPE - label for type of unit (MAIN, PRHEAD).

X - calculated multiplicative factor to obtain absolute count per unit measurement from original count (MAIN, PRHEAD); array of data values to be punched (PPUNCH); numeric value (CODE, PERCENT).

XK - fraction of slide counted (PRHEAD).

XN - ratio of treated sample weight to slide weight (PRHEAD).

XX - temporary word to hold interim results of calculations.

Y - calculated multiplicative factor to obtain absolute count per unit measurement from original count for scan counts (MAIN, PRHEAD); reordered list of taxon names (NEWORD); alphabetic (coded) value (CODE).

DICTIONARY OF VARIABLES FOR PRPLOT

A - line of print for histograms.

ASCALE - scale factor.

AST - word containing "*", used for histograms.

BLANK - word filled with alphabetic blanks.

C - data matrix.

DEPTH - list of levels, used for profile samples only.

F - portion of format for reading data fields.

FMT - basic format for data cards.

I - general index variable.

IA - data type code as read from data card.

IC - card number.

IDEPTH - flag to differentiate between profile and single fossil samples.

IFF - flag for indicating presence of asterisks in array A, also index for array OFLOW.

IG - group number.

IGR - array of taxon numbers defining ends of groups.

IGSCALE - array of scale designations for groups.

II - index number for first level in a section.

IJ - index number for last level in a section.

IS - number of taxa included in exotics summary.

ISUM - array of flags selecting taxa for exotics summary.

ITY - code for data type.

ITYPE - first letter of data type, right justified and zero filled.

J - general index variable.

JJ - scale number.

K - index used for last value to be read from data card, also bar length.

L - sample sequence number, also number of samples.

LABEL - array of taxon names.

LOC - site identification used for sequence checking.

LSC - scale number for previous taxon.

M - index for array A.

MM - number of levels per section, set to 120.

NAME - site identification as read from data card.

NT - number of taxa + 1 (to include exotics summary).

NTAXA - number of taxa.

NV - array containing number of taxa per card for data types.

NVAL - number of taxa per card.

OFLOW - array to hold truncated values.

SCALE - array of scale factors.

SCAN - word containing "+", used for histograms.

TIMES - array containing scale factor labels.

TITLE - site description.

TYPE - data type names.

VAL - value corresponding to bar length.

VALABEL - value for labeling bar length.

DICTIONARY OF VARIABLES FOR GROFORM

DSHANE - Shannon's diversity measure for Ecology categories.

DSHANL - Shannon's diversity measure for Growth Form categories.

DSIM - Simpson's diversity measure for Growth Form categories.

ESUM - array of flags assigning taxa to Ecology categories.

I - general index variable.

IC - card number.

IE - word containing "E".

IL - word containing "L".

ISITE - site identification.

IT - data type code.

J - category number.

LOC - sample identification.

LSUM - array of flags assigning taxa to Growth Form categories.

N - total number of taxa represented in sample.

NE - number of Ecology categories, set to 4.

NG - total number of categories, set to 10.

NL - number of Growth Form groups, set to 6.

NTAXA - number of taxa.

PE - array of percentage values for Ecology categories.

PL - array of percentage values for Growth Form categories.

SUM - total pollen count for sample.

X - array of taxon counts for sample.

XE - array of sums of pollen counts for Ecology categories.

XL - array of sums of pollen counts for Growth Form categories.

DICTIONARY OF VARIABLES FOR DISPLAY

A - working storage for a word of the title (TLENGTH).

C - array containing input data (MAIN, READATA, TRUNC, EXOTICS).

CPI - array containing scale designations in units per inch (RSCALES).

CUTOFF - array containing truncation points for each scale (MAIN, RSCALES, EXOTICS).

D - array of Y locations for plotting bars (MAIN, VSCALE, TRUNC, CONNECT, EXOTICS).

DEPTH - array of levels or sample sequence numbers (MAIN, READATA, LEVEL, VSCALE, EXOTICS).

DIFF - distance between adjacent levels plotted (VSCALE).

DINT - standard interval between levels for profile samples (MAIN, LEVEL, VSCALE).

DTYPE - array containing data type names (SETTYPE).

Note: Capitalized names in parentheses indicate routines where the variable is used; no such designation indicates the main program only.

DZERO - depth of first level in cm (VSCALE).

FIRST - index number referencing first bar to be joined (CONNECT).

GAPFROM - the words GAP FROM (VSCALE).

GNAME - array of group names for relative summary (MAIN, EXOTICS).

H - height of letters to be plotted (TITLER, YAXIS, DRAWSCL).

HALF - half the height of letters to be plotted (YAXIS).

HIGHEST - the word HIGHEST (VSCALE).

HOLE - the plotter distance equivalent to ten standard intervals (VSCALE).

I - level index number (TRUNC); general index variable in most routines.

IA - type code as read from data card (READATA).

IAR - flag for indicating small-scale or large-scale units (DRAWSCL).

IC - card number as read from data card (READATA).

IDEPTH - flag to specify profile sample (MAIN, VSCALE, YAXIS, TRUNC, CONNECT, EXOTICS).

IDUM - array of flags specifying dummy levels or samples (MAIN, LEVEL, VSCALE, YAXIS, TRUNC, CONNECT, EXOTICS).

IEX - flag indicating that exotics summary has been done.

IG - group number for absolute data.

IGAP - difference between number of levels read in and number of intervals calculated (VSCALE).

IGR - array of taxon numbers indicating group divisions.

IJ - group number for summary.

ISTART - flag indicating plotter has been initialized.

ISTOP - flag indicating more levels to be read and plotted (MAIN, READATA).

ISUM - array of group designations for summary.

ISUMM - flag indicating presence of summary.

ITRUNC - flag indicating bar to be truncated (MAIN, TRUNC, CONNECT).

ITY - data type code (MAIN, TITLER, SETTYPE, READATA, DRAWSCL, EXOTICS).

ITYPE - internal alphabetic code for first letter of data type as read in (MAIN, SETTYPE, READATA).

IX - largest number which is a power of ten less than a given number (RSCALES).

IYS - scale number (VSCALE).

J - index number for taxa (MAIN, TRUNC); number of letters in title (TLENGTH/TITLER); general index variable in many subroutines.

JARE - array of flags specifying small or large units for Ecology data (DRAWSCL).

JARL - array of flags specifying small or large units for Growth Form data (DRAWSCL).

JTYPE - array of internal alphabetic codes for first letter of each data type (SETTYPE).

JX - half of IX (RSCALES).

K - scale factor index (MAIN); general index variable in some subroutines.

KZ - flag indicating status of connections over bars.

L - number of levels (MAIN, VSCALE, YAXIS, TRUNC, CONNECT, EXOTICS); counter for levels (READATA, LEVEL).

LAB - increment in labels for summary (EXOTICS).

LABEL - array of taxon names.

LABINC - array containing the plot distance between scale labels (MAIN, RSCALES, DRAWSCL, EXOTICS).

LABY - integer equivalent of YLAB (YAXIS).

LAST - number of cards expected for each sample or level (READATA); index number referencing bar after the last one to be joined (CONNECT).

LINE - array of flags for horizontal lines indicating breaks (dummy levels or samples) on summary (EXOTICS).

LOWEST - the word LOWEST (VSCALE).

LSC - index number of scale used for previous taxon.

LUNIT - interval between labels (DRAWSCL).

LZ - index number of level being processed, plus one (MAIN, EXOTICS).

M - multiple of IX or JX for labeling (usually 1, 2, or 5) (RSCALES); number of groups in summary (EXOTICS).

N - index variable (RSCALES); number of bars to be joined (CONNECT).

NAME - array of labels for non-depth samples (MAIN, LEVEL, VSCALE, YAXIS).

NC - counter for data cards (READATA).

ND - number of letters in name of data type (TITLER).

NINT - number of intervals as calculated from difference between first and last level designations and standard interval between levels (VSCALE).

NL - number of horizontal lines to be drawn (DRAWSCL).

NLET - number of letters to be drawn for taxon names (MAIN, VSCALE).

NN - array of word sizes for data types (TITLER); working storage for NU (KU).

NSC - array of scale designations for each taxon (MAIN, DRAWSCL).

NSX - scale number for exotics summary (MAIN, DRAWSCL).

NTAX - taxon number (DRAWSCL).

NTAXA - number of taxa (MAIN, READATA).

NTENS - number of digits in a number, less one.

NTHOU - number of ",000" groups in a number (DRAWSCL).

NU - base for which power is found (KU).

NUM - label for scale (DRAWSCL).

NUMB - portion of label to left of left-most comma (DRAWSCL).

NUMM - portion of label increment to left of left-most comma (DRAWSCL).

NV - array of numbers of taxa per card for each data type (READATA).

NVAL - selected number of taxa per card (READATA).

NX - number for which smallest power less than or equal to it is found (KU).

SCLFACT - array of conversion factors from input units to inches, for each scale (MAIN, RSCALES, EXOTICS).

SITE - site identification (MAIN, READATA).

TEMP - temporary storage for XSUM(I,J) (EXOTICS).

TICK - length of tick mark (YAXIS); Y-location for drawing tick mark (DRAWSCL).

TITLE - array containing the site description (MAIN, TLENGTH/TITLER).

TL - length of a section of the diagram (TITLER, YAXIS, NEWORIG).

TO - the word TO (VSCALE).

TUNIT - interval between tick marks (DRAWSCL).

TYPE - data type name for top of diagram (MAIN, TITLER, SETTYPE).

TX - summation of XSUM across levels (EXOTICS).

W - width of letters for plotting (TITLER, YAXIS, DRAWSCL); temporary storage (RSCALES).

X - array of bar lengths for a taxon (MAIN, TRUNC, CONNECT, EXOTICS); distance to move origin for plotting (NEWORIG); width of box (BOX); x-location for drawing tick mark (DRAWSCL).

XI - temporary storage for X(I).

XJ - length of title in inches (TITLER).

XL - x-location for next label (DRAWSCL).

XLAB - array containing distances between labels for each scale (MAIN, RSCALES, DRAWSCL, EXOTICS).

XLABL - distance between labels for summary (EXOTICS).

XMAX - maximum bar length for a taxon (MAIN, DRAWSCL, EXOTICS).

XN - x-location for drawing number (DRAWSCL).

XSCALE - scale factor for a taxon (MAIN); scale factor for summary (EXOTICS).

XSUM - array of accumulated values for summary (MAIN, EXOTICS).

XTICK - array containing distances between tick marks for each scale (MAIN, RSCALES, DRAWSCL, EXOTICS).

XTICKS - distance between tick marks for summary (EXOTICS).

XX - x-location for plotting (TITLER, YAXIS, EXOTICS); array of relative locations for numbers of various lengths (DRAWSCL).

Y - y-location for plotting (YAXIS); another name for YBOT (BOX); y-location for scale (DRAWSCL).

YBOT - y-location for lowest level or sample (MAIN, VSCALE, YAXIS, BOX, EXOTICS).

YINT - standard distance between levels or samples (VSCALE).

YLAB - label for vertical axis (YAXIS).

YS - y-location for numbers (DRAWSCL).

YSCALE - array of scales for vertical distance (VSCALE).

YSCL - selected scale for vertical distance (VSCALE).

YSTRUNC - fraction of standard interval used for drawing truncations (VSCALE, TRUNC, CONNECT).

YSZERO - fraction of standard interval used for drawing from bar end to origin (VSCALE, TRUNC, CONNECT).

YY - y-location for plotting label (EXOTICS).

DICTIONARY OF VARIABLES FOR DGTIZR

AFORM - format for printing variable names.

C - array of final values (taxa x levels).

FORM - format for printing final values.

FULSCAL - diagram value corresponding to maximum digitizer reading from a given template.

I - general index variable.

INC - increment between levels on diagram.

ITY - code for data type (absolute or relative).

ITYPE - first letter of data type as read from card.

IW - array holding field widths for data types.

J, K, L - general index variable and counter.

LARGE - input order number of first taxon with larger full-scale value.

LEV - level of sample in mm.

LO - initial level.

M, N - general index variable.

NAME - array of taxon names.

NC - array holding number of fields per card for data types.

NLEVELS - number of levels in diagram.

NOUT - array containing taxon output order numbers in the order read in.

NT - taxon number as read from data card (referencing position in array NOUT).

NTAX - input order number of taxon being processed.

NTAXA - total number of taxa.

PFORM - format for punching data cards.

RINC - increment between levels on diagram in cm.

RLEV - level of sample in cm.

SITE - site identification code.

X - digitizer output values as read from a card.

XMAX - maximum digitizer reading from a given template.

XMIN - minimum digitizer reading from a given template.

APPENDIX II

PLOTTER ROUTINES USED BY DISPLAY AND LEGEND

(Note: X, Y, and H are always in inches.)

LINE (X, Y, N, K) - connects a series of points with straight line segments.
- X: array containing X-coordinates.
- Y: array containing Y-coordinates.
- N: number of points to be connected.
- K: 1 indicates all points to be connected.

NUMBER (X, Y, H, F, T, N) - plots a number.
- X, Y: coordinates of lower left corner of first digit of number.
- H: height of characters (should be a multiple of .07).
- F: number to be plotted.
- T: angle in degrees along which F is to be plotted; positive is counterclockwise from horizontal.
- N: number of digits to the right of the decimal point or BCD character string specifying format conversion for F.

PEND (X) - terminates the plot file.
- X: distance pen is to be moved from current origin before termination.

PLOT (X, Y, I) - moves pen from current position to specified location.
- X, Y: coordinates of destination point.
- I: pen position (1 = same as last call to PLOT, 2 = pen lowered, 3 = pen raised).

PORGN (X, Y) - moves origin to new location (no line drawn).
- X, Y: coordinates of new origin.

PSTART (NF, NT) initializes plotter.
- NF: maximum length of plot in feet.
- NT: logical unit number for plot tape.

SYMBOL (X, Y, H, I, T, N) - plots BCD characters.

X, Y: coordinates of lower left corner of first character.

H: height of character.

I: array of characters to be plotted.

T: angle in degrees along which F is to be plotted; positive is counterclockwise from horizontal.

N: number of characters to be plotted.

APPENDIX III

SHORT CARD SETUPS FOR EACH PROGRAM

```
C   POLDATA
C
C   PROGRAM TO CONVERT RAW COUNT DATA TO RELATIVE AND ABSOLUTE DATA
C
C   DEVELOPED IN 1974-75 BY MARGARET M. ECCLES
C   UNDER THE DIRECTION OF MARGARET HICKEY
C
C CARD SETUP REQUIRED
C
C   1  OPTION CARDS (COLUMNS 1-5)
C     PUNCH     FOR PUNCHED OUTPUT
C     DEPTH     TO INDICATE PROFILE SAMPLES
C     TRAP      TO INDICATE SAMPLES FROM TRAPS
C     NOTE: DEPTH AND TRAP CANNOT BE USED TOGETHER
C   2  TITLE CARD
C     COLS  1-60    ALPHANUMERIC TITLE TO APPEAR AT TOP OF EACH PAGE
C          61-80    UP TO 5 NAMES INDICATING POLLEN TYPES TO BE EXCLUDED
C                   FROM COUNTS.  TO EXCLUDE ALL TAXA ON LAST CARD,
C                   PUNCH S IN COLUMN 62.
C           (NOTE:  IF COLS. 61-64 CONTAIN THE WORD SAME, CARDS 3 - 5 MAY
C                   BE ELIMINATED.  ALL INFORMATION PROVIDED BY THESE
C                   CARDS WILL BE ASSUMED TO BE THE SAME AS FOR THE
T                  PRECEDING SITE.
C           ALSO, IF MORE THAN 5 EXCLUSIONS ARE NEEDED, PUNCH THE WORD
C                   MOR IN COLUMNS 78-80 AND INCLUDE ANOTHER CARD WITH
C                   THE REMAINDER OF TAXA NAMES, BEGINNING WITH COLUMN 2
C                  INSTEAD OF COLUMN 62.  UP TO 24 TAXA MAY BE EXCLUDED.
C           WARNING - IF A TITLE CARD CONTAINS T,H,S. OR . IN
C             COLUMN 10 IT IS LIKELY TO BE INTERPRETED AS A
C             DATA CARD OR LEVEL HEADER CARD WHEN READ AS THE
C             SECOND (OR MORE) SITE IN A STACKED SEQUENCE.
C   3  UNIT CARD
C     COLS  1 - 6 NAME OF UNITS (E.G. CC, GM, SQ.CM.)
C                 (BLANK UNIT INDICATES NO ABSOLUTE TO BE CALCULATED)
C          11-14 TYPE OF UNITS  (E.G. VOL, WT, AREA)
C   4  NAME CARDS
C     COLS  1- 5    IDENTIFICATION FOR THIS SITE
C             10    FLAG (T=TREES, H=HERBS, S=SPORES)
C             14    CARD NUMBER
C          16-18    NAME OF FIRST POLLEN TYPE
C          20-22    NAME OF SECOND POLLEN TYPE
C          24-26    NAME OF THIRD POLLEN TYPE
C           ...     ...
C        FOR UP TO 16 TYPES
C   5  REORDERING
C     IF REORDERING IS NOT DESIRED, INSERT ONE BLANK CARD.  OTHERWISE,
C     AT LEAST TWO CARDS ARE REQUIRED.
C           1) NUMBER OF ITEMS TO BE REORDERED, PUNCHED IN COLS. 2 - 3
C              (THIS PERMITS ELIMINATION OF UNWANTED TAXA)
C           2) LIST OF NEW ORDER, BEGINNING IN COL.1, WITH NUMBERS
C              SEPARATED BY COMMAS, E.G. 1,2,5,10,4,6
C              (NOTE: IT IS ASSUMED THAT REORDERING WILL NOT
C              CHANGE THE POSITION OF THE FIRST TAXON IN THE
C              THIRD (SPORE) GROUP RELATIVE TO THAT GROUP)
C   6  SLIDE HEADER CARD
C     COLS  1- 5    IDENTIFICATION FOR THIS SITE
C           6- 9    FOR DEPTH SAMPLES, DEPTH IN MM
C                   FOR OTHER SAMPLES, SAMPLE IDENTIFICATION
C          (NOTE: IF NEITHER TRAP NOR DEPTH OPTION IS
C                 SELECTED, COLS. 1 - 9 WILL BE PRINTED AS
C                 THE SLIDE IDENTIFICATION.)
C          10-14    SLIDE WEIGHT IN GRAMS
```

```
C          (NOTE: DECIMAL POINT MUST BE IN COLUMN 10)
C          15-19   TREATED SAMPLE WEIGHT
C          20-24   SAMPLE WEIGHT,AREA OR VOLUME
C          25-29   NUMBER OF TRAVERSES
C          30-31   MICROSCOPE TYPE
C          32-33   SLIDE LENGTH
C          34-35   MICROSCOPE POWER
C          36-40   NUMBER OF POSSIBLE TRAVERSES
C          41-44   SCAN COUNT FOR SPRUCE
C          45-48   SCAN COUNT FOR PINE
C          51-55   NUMBER OF EXOTIC TRACER GRAINS ADDED
C          66-80   TYPE OF MOSS POLSTER
C    7  DATA CARDS
C      COLS  1- 5   IDENTIFICATION AS FOR LEVEL HEADER CARD
C            6- 9   IDENTIFICATION AS FOR LEVEL HEADER CARD
C              10   FLAG AS FOR NAME CARDS
C           11-13   COUNT (-1 FOR SCANS)
C              14   CARD NUMBER
C           15-18   VALUE FOR FIRST POLLEN TYPE
C           19-22   VALUE FOR SECOND POLLEN TYPE
C           23-26   VALUE FOR THIRD POLLEN TYPE
C            ...     ...
C         FOR UP TO 16 TYPES
C    6 - 7 MAY BE REPEATED FOR AS MANY SLIDES AS DESIRED.
C    2 - 7 MAY BE REPEATED FOR AS MANY SITES AS DESIRED, USING THE SAME
C         OPTIONS AS THE PREVIOUS SITE.
C     TO INCLUDE A SITE WITH DIFFERENT OPTIONS, INSERT AN END-OF-RECORD
C         CARD AND REPEAT 1 - 7.
C
```

```
C     PRPLOT
C
C    PROGRAM TO DRAW HISTOGRAMS ON PRINTER OUTPUT
C
C    DEVELOPED IN 1975 BY MARGARET M. ECCLES
C    UNDER THE DIRECTION OF MARGARET HICKEY
C
C    CARD SET-UP
C
C      1) OPTION CARD:  DEPTH IN COLS. 1 - 5 FOR PROFILE SAMPLES ONLY
C      2) TITLE CARD:  80 COLUMNS, SITE DESCRIPTION
C      3) NUMBER OF TAXA : COLUMNS 2-3
C      4) TAXON NAMES:  20 COLUMNS, ONE NAME PER CARD
C      5) DATA TYPE:  COLUMN ONE MUST CONTAIN FIRST LETTER
C      6) EXOTICS SUMMARY: (ABSOLUTE ONLY)
C         1 INDICATES TAXON IS TO BE INCLUDED IN SUMMARY, 0 OR BLANK
C           INDICATES TAXON IS NOT INCLUDED.
C         COL. 1  FLAG FOR FIRST TAXON
C         COL. 2  FLAG FOR SECOND TAXON
C           ...   ...
C           ETC. FOR AS MANY TAXA AS SPECIFIED IN 3).  IF MORE THAN 80,
C           CONTINUE ON SECOND CARD
C      7) SPLIT POINTS: (ABSOLUTE ONLY)
C         COL. 2-3  NUMBER OF LAST TAXON IN FIRST GROUP
C         COL. 5-6  NUMBER OF LAST TAXON IN SECOND GROUP
C         COL. 8-9  NUMBER OF LAST TAXON IN THIRD GROUP
C      8) SCALES: (ABSOLUTE ONLY)
C         COL. 3  SCALE FOR FIRST GROUP
C         COL. 6  SCALE FOR SECOND GROUP
C         COL. 9  SCALE FOR THIRD GROUP
C         SCALES ARE:  1  *=200
C                      2  *=2000
C                      3  *=20000
```

```
C     9) DATA CARDS:
C       COLS. 1- 5  SITE IDENTIFICATION
C       COLS. 6- 9  SAMPLE OR LEVEL DESIGNATION
C       COL.    10  DATA TYPE
C       COLS.11-13  IGNORED
C       COL.    14  CARD NUMBER
C       COLS.15-78  DATA FIELDS - 16 FOUR-COLUMN FIELDS FOR RELATIVE
C                                 OR 8 EIGHT-COLUMN FIELDS FOR ABSOLUTE
C
```

```
C    GROFORM
C
C   PROGRAM TO PUNCH SUMS OF LIFE FORM AND ECOLOGY TYPES AND TO CALCULATE
C     SIMPSON AND SHANNON DIVERSITY ESTIMATES
C
C    DEVELOPED IN 1975 BY MARGARET M. ECCLES
C    UNDER THE DIRECTION OF MARGARET HICKEY
C
C    CARD SETUP
C   1  NUMBER OF TAXA  COLUMNS 2-3
C   2  TAXA FOR LIFE FORM SUMS   ONE TAXON PER COLUMN
C         PUNCH 1 FOR TREES
C               2 FOR SHRUBS
C               3 FOR HERBS
C               4 FOR GRAMINOIDS
C               5 FOR MOSSES
C               6 FOR FERNS
C   3  TAXA FOR ECOLOGY SUMS   ONE TAXON PER COLUMN
C         PUNCH 1 FOR EXOTICS
C               2 FOR XERIC
C               3 FOR MESIC
C               4 FOR HYDRIC
C
C   4  DATA CARDS (AS OUTPUT BY POLDATA)
C      COLS.  1-5  SITE NAME
C             4-9  LEVEL OR LOCATION
C            11-13 NOT USED (CONTAINS LARGEST COUNT TOTAL)
C               14 CARD NUMBER
C            15-68 ABSOLUTE CALCULATED COUNTS FOR TAXA, UP TO EIGHT
C                  PER CARD IN 8-COLUMN FIELDS
C   5  BLANK CARD
C   NOTE: THE ABOVE SEQUENCE 1-5 MAY BE REPEATED FOR SEVERAL SITES
C
```

```
C    DISPLAY
C
C   PROGRAM TO DRAW POLLEN DIAGRAMS ON THE CALCOMP PLOTTER
C   WRITTEN 1974-1975 BY MARGARET M. ECCLES
C   UNDER THE DIRECTION OF MARGARET HICKEY
C
C   CARD SET-UP
C
C    1  DEPTH CARD - FOR SAMPLES TAKEN FROM SUCCESSIVE LEVELS AT A SITE
C      COLS. 1- 5  DEPTH
C           11-15  INTERVAL BETWEEN LEVELS (MAY BE LEFT BLANK
C                  IF INTERVAL IS 2.5 CM)
```

```
C    2  TITLE CARD - UP TO 80 COLUMNS OF INFORMATION AT TOP
C                    OF EACH SECTION OF THE DIAGRAM
C    3  NUMBER OF TAXA (OR GROUPS) - COLS. 2-3
C    4  TAXA NAMES - ONE NAME PER CARD, UP TO 20 COLUMNS
C                    BEGINNING IN COLUMN 1
C    5  DATA TYPE - BEGINNING IN COL.1. ACCEPTABLE DATA TYPES ARE:
C            RELATIVE, ABSOLUTE, SCAN, LIFE FORM, ECOLOGY
C    6  SCALE INFORMATION - UP TO 8 DIFFERENT SCALES MAY BE
C                           SPECIFIED BY THE NEXT TWO CARDS.
C        A  NUMBER PER INCH (POLLEN GRAINS OR PERCENT)
C        B  CUTOFF POINT (SAME UNITS)
C       THE FORMAT FOR BOTH CARDS IS AS FOLLOWS:
C          COLS. 1-10  VALUE FOR FIRST SCALE
C                11-20  VALUE FOR SECOND SCALE
C                 ...   ...
C                71-80  VALUE FOR EIGHTH SCALE (IF NEEDED)
C    7  SCALE NUMBERS - ASSIGNS A SCALE TO EACH TAXON
C          COL. 1  SCALE NUMBER FOR FIRST TAXON
C               2  SCALE NUMBER FOR SECOND TAXON
C              ... ...
C              ETC. FOR UP TO 96 TAXA
C          FOR ABSOLUTE DATA SPECIFY SCALE FOR EXOTICS SUMMARY
C              (IF ANY) IN COL. NO. NTAXA+1
C             (WHERE NTAXA = NUMBER OF TAXA)
C    8  SUMMATION INFORMATION (TYPES RELATIVE AND ABSOLUTE ONLY)
C        SPECIFIES TAXA TO BE SUMMED AND PLOTTED AS A UNIT AT END OF
C        DIAGRAM.  THREE GROUPS ARE PERMITTED FOR RELATIVE DATA, TO BE
C        CONVERTED TO PERCENTAGES BEFORE PLOTTING.  ONLY ONE GROUP IS
C        PERMITTED FOR ABSOLUTE, TO BE LABELED EXOTICS.  THIS WILL NOT
C        BE CONVERTED TO PERCENTAGES.  SPECIFY GROUP ZERO FOR TAXA
C        NOT TO BE INCLUDED IN SUMMARY.
C      COL. 1  GROUP NUMBER FOR FIRST TAXON
C           2  GROUP NUMBER FOR SECOND TAXON
C          ... ...
C          ETC FOR UP TO 80 TAXA (BEGIN A SECOND CARD IF MORE THAN 80)
C    9  FOR RELATIVE ONLY:
C         COLS. 1-10  NAME OF FIRST GROUP
C               11-20  NAME OF SECOND GROUP
C               21-30  NAME OF THIRD GROUP
C       FOR ABSOLUTE ONLY:
C         8  SECTION INDICATORS - UP TO THREE SECTIONS MAY BE SPECIFIED.
C               THE EXOTICS SUMMARY (IF ANY) WILL BE PLOTTED AT THE END
C               OF THE LAST SECTION OR AFTER THE SECTION WHOSE INDICATER
C               IS PRECEDED BY A MINUS SIGN.
C             COLS. 1-3  ORDER NUMBER OF LAST TAXON IN FIRST
C                        SECTION
C                   4-6  ORDER NUMBER OF LAST TAXON IN SECOND
C                        SECTION
C                   7-9  ORDER NUMBER OF LAST TAXON IN THIRD
C                        SECTION
C   10  DATA
C   11  BLANK CARD
C  NOTE:  SEVERAL DATA TYPES FOR THE SAME LOCATION MAY BE
C    PLOTTED BY REPEATING 5-11.
C         SEVERAL LOCATIONS MAY BE PLOTTED BY USING AN
C    END-OF-RECORD CARD AND THEN REPEATING 1 - 11.
C
```

```
C     LEGEND
C
C    WRITES LABELS NECESSARY TO COMPLETE DISPLAY DIAGRAM
C     ON CALCOMP PLOTTER
C
C    DEVELOPED IN 1975 BY MARGARET M. ECCLES
C    UNDER THE DIRECTION OF MARGARET HICKEY
C
C    CHARACTER SIZES ARE IN INCREMENTS OF .07 INCHES
C   INPUT DECK CONSISTS OF CARDS IN THE FOLLOWING FORMAT:
C      COL. 1       INTEGER NUMBER INDICATING SIZE OF CHARACTER
C                      (HEIGHT IS NUMBER TIMES .07 INCHES)
C      COLS.3 - 32 LABEL
C    REPEAT FOR AS MANY LABELS AS DESIRED
C
```

```
C     DGTIZR
C
C    PROGRAM TO CONVERT DIGITIZER OUTPUT TO POLDATA-COMPATIBLE OUTPUT
C
C    DEVELOPED IN 1975 BY MARGARET M. ECCLES
C    UNDER THE DIRECTION OF MARGARET HICKEY
C
C       CARD INPUT:
C    1) PARAMETER CARD
C       COLS.  1- 5  SITE NAME
C       COLS.  9-10  NUMBER OF TAXA
C       COLS. 13-15  NUMBER OF LEVELS
C       COLS. 17-20  DEPTH OF FIRST LEVEL IN MM.
C       COLS. 23-25  INTERVAL BETWEEN LEVELS
C    2) SCALE INFORMATION CARD
C       COLS.  1- 5  MINIMUM VALUE FROM DIGITIZER
C       COLS.  6-10  MAXIMUM VALUE FROM DIGITIZER
C       COLS. 11-20  FULL SCALE VALUE
C       COLS. 24-25  SEQUENCE NUMBER OF FIRST TAXON USING A FULL SCALE
C                    VALUE TEN TIMES AS LARGE AS PREVIOUS TAXA
C    3) TAXON NAME CARDS
C       COLS.  2- 3  TAXON NUMBER
C       COLS.  6-14  TAXON NAME
C    4) TYPE CARD (ABSOLUTE OR RELATIVE)
C    5) DATA CARDS
C       COLS.   1- 2  IDENTIFICATION (IGNORED BY PROGRAM)
C       COLS.  3- 4  TAXON SEQUENCE NUMBER
C       COL.       5  CARD NUMBER
C       COLS.  6- 8  VALUE FOR FIRST LEVEL
C       COLS.  9-11  VALUE FOR SECOND LEVEL
C                ...  ...
C       COLS. 78-80  VALUE FOR 25TH LEVEL
C       CONTINUED FOR AS MANY CARDS AS NEEDED PER TAXON.  BEGIN AGAIN
C       WITH CARD ONE FOR NEXT TAXON.  THERE MUST BE ONE SET OF CARDS FOR
C       EACH TAXON, AND EACH SET MUST CONTAIN DATA FOR THE NUMBER OF
C       LEVELS SPECIFIED.
C
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APPENDIX IV

THREE-LETTER CODES FOR TAXON NAMES

Trees and Shrubs

ABI - Abies
ACE - Acer
ALN - Alnus
BET - Betula
CAR - Carpinus
CON - Conifers
COR - Corylus
FAG - Fagus
FRA - Fraxinus
JUG - Juglans
JUN - Juniperus
LAR - Larix
QER - Quercus
PIC - Picea
PIE - Pinus edulis
PIN - Pinus
PIP - Pinus ponderosa
POP - Populus
PSE - Pseudotsuga
SAL - Salix
THU - Thuja
TLA - Tilia
TSU - Tsuga
ULM - Ulmus

Herbs

AMB - Ambrosia
ARB - Arabis
ART - Artemisia
CAM - Campanula
CAR - Caryophyllaceae
CEN - Centaurea
CER - Cerastium
CHE - Chenopod
CIR - Circaea
CLG - Compositae-long-spined
COL - Compositae-Liguliflorae
COM - Compositae
COT - Compositae-Tubuliflorae
CNS - Cornus
CRU - Cruciferae
CST - Compositae-short spined
DRO - Drosera
EPI - Epilobium
EPN - Ephedra nevadensis type
EPT - Ephedra torreyana type
ERG - Eriogonum
GIL - Gilia
GRA - Gramineae
LRR - Larrea
LEG - Leguminosae
LIN - Linnaea
MYR - Myrica
NUP - Nuphar
NYM - Nymphaea
OPT - Opuntia
PED - Pedicularis
PHL - Phlox
PLA - Plantago
PLM - Polemonium
POL - Polygonum
POT - Potentilla
PTG - Potamogeton
RAN - Ranunculaceae
RHU - Rhus
RIB - Ribes
ROS - Rosaceae
RUB - Rubus
SAN - Sanguisorba
SAR - Sarcobatus
SAX - Saxifracaceae
SED - Sedum
SPA - Sparganium
SYM - Symphiocarpus
THA - Thalictrum
TYF - Typha
UMB - Umbelliferae
URT - Urticaceae

Spores, etc.

CRY - Cryptogramma
CYP - Cyperaceae
ERI - Ericaceae
EQU - Equisetum
FIL - Filicales
LYC - Lycopodium spp.
LYL - Lycopodium clavatum
LYM - Lycopodium mundatum
LYS - Lycopodium selago
PLD - Polypodium
PLT - Polytrichum
PTE - Pteridium
SEL - Selaginella
SPH - Sphagnum
TIL - Tilletia
XXE - exotic Eucalyptus
XXL - exotic Lycopodium

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