APPENDIX IV

COMPUTER PROGRAMS

When handling the large array of unfamiliar pollen analytical data from tropical lowland samples, the utility of computer assistance becomes obvious. Different base sums for relative diagrams can be evaluated rapidly, as can the effect on PDR values of applying alternative sediment accumulation rates. This accuracy and flexibility should, in theory, allow for better interpretation of the available evidence.

Modified versions of two pre-existing FORTRAN V programs for manipulation of palynological data (Raine, 1974), run on the ANU UNIVAC 1100/42 computer, were used extensively in this study. The program sources are listed in full on following pages.

Program POLGRP checks the format of the raw data and produces tables of pollen counts, such as those in Appendix III. The program can also amalgamate any combination of samples and/or taxa and tabulate the results, or store them in the same format as the original data.

Program PLOTABS is an expanded version of Dodson's PLNSPRS and PLNGPS programs (Dodson, 1972) and incorporates many of their features. In addition, PLOTABS can handle 'absolute' pollen analytical data, and, using ANU library routine ANUPLOT, writes plotfiles for subsequent production on a CALCOMP 960 plotter. Using the raw data, or the output from POLGRP, program PLOTABS allows for amalgamation of taxa, calculation of relative frequencies in relation to any base sum, and multiplication of counts by a factor to produce values for pollen concentration or

PDR. With some manipulation, publication standard relative pollen diagrams can be drawn via the program. The pollen concentration or PDR diagrams are often less satisfactory due to the limited horizontal scaling available. All pollen diagrams in this thesis have been re-drawn from computer-generated plots. The PLOTABS program could be substantially improved by addition of more sophisticated plot-scaling, and sub-routines for the calculation of confidence limits on percentage and 'absolute' values.

```
C       PROGRAM POLGRP       VERSION 2,  4 AUG 1977
C       THIS PROGRAM TAKES RAW SPECTRA AND FORMS COUNTS FOR GROUP
C       AND FOR GROUPS OF SPECTRA ( LEVELS OF POLLEN DIAGRAM)
C
C       INPUT FORMAT IS 20F3.0 FOR DATA, UNIT 1
C       OUTPUT FORMAT IS 20F3.0 FOR DATA, UNIT 24
C
C       FIRST DATA CARD: NOTAX,NOSPEC,NGRPS,NLEV,NOUT
C       NOTAX IS NO OF TAXA    (MAX 200)
C       NOSPEC IS NO OF SPECTRA    (MAX 30)
C       NGRPS IS NO OF GROUPS TO BE MADE
C       NLEV IS NO OF LEVELS OF SPECTRA TO BE MADE
C       NOUT IS LOGICAL UNIT NO FOR OUTPUT OF FINAL TABLE
C       RAW DATA SET CARDS FOLLOW    (2013,7X,2A5,I3)
C       GROUP NAME CARDS ARE EACH FOLLOWED BY TAXON NO. CARDS
C       GROUP NAME CARD FORMAT (3X,A5)
C       TAXON NO. CARD FORMAT (I3)
C       A CARD WITH 999 IN COLS. 1-3 TERMINATES GROUP CARD SET
C       LEVEL NAME CARDS ARE EACH FOLLOWED BY SPECTRUM NO. CARDS
C       LEVEL NAME CARD FORMAT (3X,2A5)
C       SPECTRUM NO. CARD FORMAT (I3)
C       A CARD WITH 999 IN COLS. 1-3 TERMINATES LEVEL CARD SET
C
        DIMENSION NAMGRP(200),LEVEL(30),LCONT(30)
        INTEGER   FDATA(200,30),DATA(200,30),GDATA(200,30)
        EQUIVALENCE (DATA(1,1),GDATA(1,1))
C       READ CONTROL CARD
        READ(1,400)NOTAX,NOSPEC,NGRPS,NLEV,NOUT
  400   FORMAT()
C       READ IN DATA
        DO 30 J=1,NOSPEC
        READ(1,100) (DATA(I,J),I=1,NOTAX)
  100   FORMAT(20I3)
   30   READ(30,101) LEVEL(J),LCONT(J)
  101   FORMAT(67X,2A5,3X)
        NS=1
        NF=20
    4   IF(NOTAX-NF)41,41,1
```

Program POLGRP (Cont.)

```
C       PRINT OUT TABLE
     41 NF=NOTAX
      1 WRITE ( 3,110)
    110 FORMAT(1H1,/,1X,'LEVEL          TAXON NUMBER')
        WRITE ( 3,120) (I,I=NS,NF)
    120 FORMAT(14X,20(I3,1X),/,)
        DO 42 J=1,NOSPEC
     42 WRITE ( 3,130) (LEVEL(J),LCONT(J),(DATA(I,J),I=NS,NF))
    130 FORMAT(1X,2A5,3X,20(I3,1X))
        IF(NOTAX.EQ.NF) GO TO 50
        NS=NS+20
        NF=NF+20
        GO TO 40
     50 I=1
        DO 51 KJ=1,200
        DO 51 KI=1,30
     51 FDATA(KJ,KI)=0
        WRITE ( 3,270)
C       READ GROUP NAME & COMPOSITION CARDS & FORM GROUPS
    270 FORMAT(1H1)
        READ( 1,200)NAMGRP(I)
    200 FORMAT(3X,A5)
        WRITE( 3,200)NAMGRP(I)
      2 READ( 1,210) ICOLL
    210 FORMAT(I3)
        IF(ICOLL)91,5,3
      3 IF(ICOLL.EQ.999) GO TO 7
        WRITE( 3,260) ICOLL
    260 FORMAT(7X,I3)
        DO 4 J=1,NOSPEC
      4 FDATA(I,J)=FDATA(I,J)+DATA(ICOLL,J)
        GO TO 2
      5 I=I+1
        READ( 1,200)NAMGRP(I)
        WRITE (3,200) NAMGRP(I)
        GO TO 2
      7 IF(NGRPS.NE.I) GO TO 95
        J=1
        DO 71 KJ=1,200
        DO 71 KI=1,30
     71 DATA(KJ,KI)=0
        WRITE( 3,270)
```

Program POLGRP (Cont.)

```
C       READ LEVEL NAME & COMPOSITION CARDS & FORM GROUPS
        READ( 1,201)LEVEL(J),LCONT(J)
        WRITE( 3,201) LEVEL(J),LCONT(J)
  201   FORMAT(3X,2A5)
    8   READ ( 1,210) ICOLL
        IF(ICOLL)91,11,9
    9   IF(ICOLL.EQ.999) GO TO 13
        WRITE( 3,260) ICOLL
        DO 10 K=1,NGRPS
   10   GDATA(K,J)=GDATA(K,J)+FDATA(K,ICOLL)
        GO TO 8
   11   J=J+1
        READ( 6,201)LEVEL(J),LCONT(J)
        WRITE ( 3,201) LEVEL(J),LCONT(J)
        GO TO 8
   13   IF(J.NE.NLEV) GO TO 90
        NS=1
        NF=15
   14   IF(NGRPS-NF)15,15,16
   15   NF=NGRPS
C       PRINT OUT FINAL TABLE OF GROUPED SPECTRA
   16   WRITE( NOUT,300) (NAMGRP(I),I=NS,NF)
  300   FORMAT(1H1,//////,19X,15(A5,1X),/,)
        DO 18 J=1,NLEV
   18   WRITE( NOUT,310) (LEVEL(J),LCONT(J),(GDATA(I,J),I=NS,NF))
  310   FORMAT(7X,2A5,15(I5,1X))
        IF(NGRPS.EQ.NF) GO TO 17
        NS=NS+15
        NF=NF+15
        GO TO 14
   17   DO 20 J=1,NLEV
        K=1
        KK=20
C       SEND DATA IN 20I3 FORMAT TO LOGICAL UNIT 24
   21   WRITE(24,80) (GDATA(I,J),I=K,KK),LEVEL(J),LCONT(J)
   80   FORMAT(20I3,7X,2A5,3X)
        IF(NGRPS.LE.KK) GO TO 20
        K=K+20
        KK=KK+20
        GO TO 21
   20   CONTINUE
   91   STOP
   90   WRITE(3,240)
  240   FORMAT(2X,'NO. OF GROUPS OR LEVELS INCORRECT AT READ-IN')
        END
```

```
C      PROGRAM PLOTABS   VERSION 2,   SEPT.1977
C      CALCULATES AND LISTS PERCENTAGES AND ABSOLUTE VALUES OF
C      MICROFOSSIL TYPES AND WRITES THESE TO A PLOTFILE (LDEV 9).
C      INCLUDE LIB E8*ANUPLOT. IN MAP
C
C      FIRST CARD : CONTROL CARD
C      COL.  1-3 NO. OF DATA BATCHES (MAX = 80)
C      COL.  4-6 NO. OF MICROFOSSIL TYPES (MAX = 200)
C      COL.  7-8 NO. OF GROUPS TO BE USED AS BASE SUMS
C                (THESE ARE ARRANGED FIRST)
C      COL. 9-10 TOTAL NO. OF GROUPS  (MAX. 24)
C      COL    11       PUT  0  FOR A RELATIVE (PERCENTAGE) DIAGRAM
C                      PUT  1  FOR AN ABSOLUTE (LINEAR SCALE) DIAGRAM
C                      PUT  2  FOR AN ABSOLUTE (LOG. SCALE) DIAGRAM
C      COL.12-15 THE STARTING VALUE FOR THE DEPTH AXIS (I4)
C      COL.16-24 DIVISION FACTOR (F9.0) FOR PLOT IF COL. 11 = 1
C      COL.25-80 HEADING FOR SITE
C
C      HEADINGS FOR GROUPS IN 2A6 FORMAT (COLS.1-12).
C
C      BLANK CARD  IF LESS THAN 24 GROUPS ARE TO BE FORMED
C
C      DATA DECK IN 20I3 FORMAT (COLS.1-60), WITH DEPTHS IN I5
C      (COLS.68-72) AND DEPTH (I5) IN COLS. 73-77.
C      COLS. 78-80 ARE FOR CARD SEQUENCE
C      NUMBERS WHICH ARE NOT READ BY THE PROGRAM.
C
C      CARDS CONTAINING LIST OF MICROFOSSIL TYPES FOR EACH GROUP:
C      FORMAT MMMXNNN,1X WHERE    MMM IS 1ST TAXON ORDINAL NO.
C                                 NNN IS 2ND TAXON ORDINAL NO.
C                                 X=1 IF TAXA MMM & NNN TO BE ADDED
C                                 X=2 IF TAXA MMM TO NNN TO BE ADDED
C      FURTHER GROUPINGS MMMXNNN,1X MAY FOLLOW THE FIRST,
C      UP TO A MAXIMUM OF 10 PER CARD.  ANY NO. OF ADDITIONAL
C      CARDS, IN THE SAME FORMAT,  MAY FOLLOW.
C      HOWEVER, IF  THE LAST CARD FOR A GROUP CONTAINS
C      10 GROUPINGS, A BLANK CARD MUST FOLLOW.
```

Program PLOTABS (Cont.)

```
C
C       CARDS WITH ABSOLUTE CORRECTION FACTORS IN F10.3 FORMAT,
C       ONE PER CARD IN COLS.1-10, IN ORDER OF INCREASING DEPTH.
C
C*******************************************************************************
C
        DIMENSION ISITE(12), LEV(80), NEV(80), PERC(25,80),CORR(80)
        DIMENSION NGP(2 ,25)
        COMMON MPLN(200), ILK
        COMMON LIST(200,80)
        DIMENSION X(400),Y(400)
        CALL PLOTC(9,32,100.0,0)
        CALL PLOT(1.5,1.5,-3)
C       READ CONTROL INFORMATION
        READ(1,10)NUM,NPLN,KNT,MANYGP,JABS,ISTAR,FACTOR,(ISITE(I),I=1,14)
   10   FORMAT(I3,I3,I2,I2,I1,I4,F9.0,14A4)
        NABS=JABS
        WRITE(3,11) (ISITE(I), I=1,14)
   11   FORMAT(1H1,5HSITE ,14A4,///)
C       READ IN GROUP NAMES
        DO 13 I=1,MANYGP
   13   READ(1,14) (NGP(J,I), J=1,2 )
        IF(MANYGP.EQ.24) GO TO 15
        READ(1,14) (NGP(J,25), J=1,2 )
   14   FORMAT( 2A6)
C       READ IN CORE DATA
   15   DO 12  IBATCH=1,NUM
        NNPLN=NPLN-20
        MNPLN=NNPLN+1
        READ(1,20)(LIST(I,IBATCH),I=1,NNPLN)
   20   FORMAT(20I3)
        READ(1,999)(LIST(I,IBATCH),I=MNPLN,NPLN),LEV(IBATCH),NEV(IBATCH)
  999   FORMAT(20I3,7X,A5,I5,3X)
   12   CONTINUE
C       DO GROUPING AND PERCENTAGE CALCULATIONS
        JUMP = 1
        KOUNT = 0
   25   KOUNT = KOUNT + 1
        IF(KOUNT - KNT) 32,32,26
   32   CONTINUE
        IF(NABS)27,27,33
   27   WRITE(3,28)
   28   FORMAT(///,1X,21HFOR NEXT CALCULATIONS,/)
   30   WRITE(3,31) (NGP(J,KOUNT), J=1,2 )
   31   FORMAT(1X,27HTHE FOLLOWING = 100 PERCENT,5X,2A6 ,///)
   33   CONTINUE
```

Program PLOTABS (Cont.)

```
      GO TO (56,103), JUMP
   56 DO 55 INIT =1,NUM
      DO 55 IT=1,24
   55 PERC(IT,INIT) = 0.0
      DO 60 KA=1,MANYGP
      CALL UTLY (NPLN)
      DO 60  K=1,NUM
      DO 60  L=1,ILK
      NTT = MPLN(L)
   60 PERC(KA,K) = PERC(KA,K) +FLOAT( LIST(NTT,K))
      NANYGP=MANYGP
      IF(MANYGP - 23) 42,42,103
   42 MANYGP = MANYGP + 1
      DO 43 KA=MANYGP,24
      DO 43 K=1,2
   43 NGP(K,KA) = NGP(K,25)
      MANYGP = MANYGP - 1
  103 DO 104 LOT=1,NUM
  104 PERC(25,LOT)=PERC(KOUNT,LOT)
      IF(JABS.NE.0) GO TO 39
      DO 102 LOT=1,NUM
      DO 102 IPERC=1,24
      IF(PEPC(25,LOT)) 67,67,68
   67 PERC(IPERC,LOT)=9999.0
      GO TO 102
   68 PERC(IPERC,LOT)=PERC(IPERC,LOT)/PERC(25,LOT)*100.0
  102 CONTINUE
  803 IMANY = 1
      JMANY = 6
C     PRINT OUT PERCENTAGE TABLES
   38 WRITE(3,110) ((NGP(J,I), J=1,2 ), I=IMANY,JMANY)
  110 FORMAT(1H1,5(/),1X,5HLEVEL,9X,6(2A6,7X),/)
      WRITE(3,111)
  111 FORMAT(1X,129(1H=)/)
      DO 115 LOT=1,NUM
  115 WRITE(3,112) LEV(LOT), NEV(LOT), (PERC(N,LOT), N=IMANY,JMANY)
  112 FORMAT(1X,A5,1X,I5,6(2X,F10.2,7X)/)
      WRITE(3,111)
      IF(JMANY - MANYGP) 41,39,39
   41 IMANY = IMANY + 6
      JMANY = JMANY + 6
      GO TO 38
   39 JUMP = 2
      IF(JABS.EQ.0) GO TO 903
C     READ IN CORRECTION FACTORS & CORRECT  DATA
      READ(1,800)(CORR(I),I=1,NUM)
  800 FORMAT(F10.3)
```

Program PLOTABS (Cont.)

```
      DO 801 J=1,NUM
      DO 801 I=1,NANYGP
  801 PERC(I,J)=PERC(I,J)*CORR(J)
  805    WRITE(3,802)
  802 FORMAT(///,1X'ABSOLUTE COUNT FIGURES',///)
      JABS=0
      GO TO 803
C     SET UP PERC FOR LINEAR SCALE ABSOLUTE COUNTS
  903 NF=10
      IF(NABS-1)908,904,906
  904 DO 905 I=2,NANYGP
      DO 905 J=1,NUM
  905 PERC(I,J)=PERC(I,J)/FACTOR
      GO TO 908
  906 NF=1
      DO 907 I=2,NANYGP
      DO 907 J=1,NUM
      IF(PERC(I,J)-1.0)907,907,909
  909 PERC(I,J)=10*ALOG10(PERC(I,J))
  907 CONTINUE
C     SET UP PLOTTER INSTRUCTION FILE
  908 DO 900 I=2,NANYGP
      NO=1
      PMAX=0.
      DO 901 J=1,NUM
      IF(PERC(I,J).GT.PMAX)PMAX=PERC(I,J)
      X(NO)=NEV(J)-ISTAR
      Y(NO)=0.
      X(NO+1)=X(NO)
      Y(NO+1)=PERC(I,J)
      X(NO+2)=X(NO)+0.02
      Y(NO+2)=Y(NO+1)
      X(NO+3)=X(NO+2)
      Y(NO+3)=0.
      NO=NO+4
  901 CONTINUE
      X(NO)=0.
      Y(NO)=0.
      X(NO+1)=254.
      Y(NO+1)=25.
      NO=NO-1
      LNTH=PMAX
      IF(PMAX.LE.0.0)GO TO 900
      IF(LNTH.LT.4)LNTH=4
      LNTH=((LNTH/10)+1)
      ALNTH=FLOAT(LNTH*0.4)
      CALL PLOT(0.0,0.0,3)
      CALL PLOT(-0.3,0.0,-3)
      A=0.4
```

Program PLOTABS (Cont.)

```
      DO 902 J=1,LNTH
      B=FLOAT(J*NF)
      C=A-0.07
      CALL SYMBOL(0.,A,0.07,13,90.,-1)
      CALL NUMBER(-0.07,C,0.07,B,90.0,-1)
      A=A+0.4
  902 CONTINUE
      CALL PLOT(0.0,0.0,3)
      CALL PLOT(0.0,ALNTH,2)
      CALL PLOT(0.0,0.0,3)
      CALL SYMBOL(-0.03,0.03,0.14,NGP(1,I),120.0,12)
      CALL PLOT(0.3,0.0,-3)
      CALL PLOT(0.0,ALNTH,2)
      CALL PLOT(0.0,0.0,3)
      CALL LINE(X,Y,NO,1,0,0)
      CALL PLOT(0.0,0.0,2)
      CALL PLOT(0.0,ALNTH+0.4,-2)
  900 CONTINUE
      GO TO 25
   26 CALL PLOT(0.0,0.0,999)
C     GROUPING SUBROUTINE
      SUBROUTINE UTLY (NPLN)
      DIMENSION LOT1(10), IA(10), LOT2(10)
      COMMON MPLN(200),ILK
      KNUT = 1
   20 READ(1,1) (LOT1(I), IA(I), LOT2(I) ,I=1,10)
    1 FORMAT(10(I3,I1,I3,1X))
      II = 1
   70 IF(LOT1(II)) 9,9,4
    4 IF(IA(II).EQ.2) GO TO 5
      MPLN(KNUT) = LOT1(II)
      KNUT = KNUT + 1
      MPLN(KNUT) = LOT2(II)
      KNUT = KNUT + 1
      GO TO 8
    5 MPLN(KNUT) = LOT1(II)
    6 IF(LOT2(II) - LOT1(II))7, 7,50
   50 LOT1(II) = LOT1(II) + 1
      KNUT = KNUT + 1
      MPLN(KNUT) = LOT1(II)
      GO TO 6
    7 KNUT = KNUT + 1
    8 II = II + 1
      IF(II - 10) 30,30,20
    9 ILK = KNUT - 1
      WRITE(3,100)ILK,(MPLN(JJ),JJ=1,ILK)
  100 FORMAT(/ I4,' TAXA IN THIS GROUP'/10(20I4/))
      RETURN
      END
```