Pgm SPEC-1 File SSPECD

```
//ARFSPC25 JOB 006,BPI,MSGLEVEL=(0,0),CLASS=B
/*ROUTE  PRINT HCLD
/*SETUP    *   TAPE=(ARFWEL SL, NO RING)
/*JOBPARM R=010
//  EXEC FORTPLOT,REGION.GO=100K,TIME.GO=5,FORT='NOSOURCE'
//STEPLIB DD DSN=SYS2.PLOT.SYSTEM.VSITLOAD,DISP=SHR
//SYSIN DD *
C  RAW DIGITIZED EVENTS ARE SAMPLED OVER A TIME WINDOW (0.4SEC),
C  AND THEN CORRECTED FOR INSTRUMENT RESPONSE AND EDGE EFFECTS.
C  THE DISPLACEMENT SPECTRA IS THEN OBTAINED FROM THE TREATED DATA,AND PLOTTED
C  ON THE CALCOMP PLOTTER (MAX PAPER LIMIT RESTRICTS THE PROCESSING TO SIX
C  EVENTS AT ANY ONE RUN).
      DIMENSION F(260),RESP(260),SPEC(130),IS(64),S(64),TAPE(9),EN(258)
     1,BIR(260),B(128),PAT(128),IBUF(1000),FF(260)
      COMPLEX CF(129),CRESP(129)
      EQUIVALENCE (CF(1),F(3)),(CRESP(1),RESP(3)),(BIR(1),B(1))
      COMMON TIME(258)
C    THIS PROGRAMME IS WRITTEN FOR A DATA WINDOW OF 256 SAMPLES
C    SPS = NO. OF SAMPLES PER SECOND (DIG. RATE) FOR THE DATA.
C   THE PERIOD OF THE SAMPLE ANALYSED SHOULD GIVE 256 SAMPLES (2**8)
C   E.G. FOR SPS =640  THEN T = 0.4 SECS.
      SPS=640
      T=256/SPS
      DO 40 I=1,256
40    TIME(I)=I
      TIME(257)=0.
C XINC =NO. OF SAMPLES PER PLOT INCREMENT (OR PER 1 CM.)
      XINC=10.0
C
C    TIME SCALE OF PLOTS : 1MM=2.56 SAMPLES=0.004SEC (I.E. 10 CM AXIS)
C
      TIME(258)=256/XINC
      PI =3.1416
      TCON=4*PI/((256/SPS)**2)
      CALL PLOTS(IBUF,4000)
      READ(5,10)(RESP(I),I=1,256)
10    FORMAT(16F5.2)
      READ(5,11) TAPE
11    FORMAT(9F5.3)
      XOT=0.0
      IRS=-1
      CALL ORSH(IRS,XINC,XOT,&999)
      CALL RRITE(RESP,' RESPONSE    ',' D.U./MICRON     ')
C
C
C    RESP: OUTPUT IN D.U. OF SYSTEM WITH AN IMPULSE INPUT OF 1 MICRON,
C    OR 1920 MICRONS/SEC FOR 1/1920 SEC,
C    SAMPLED AT 1920 SAMPLES/SEC, GAINS 1 & 50.
C
C
      CALL RHAR1(RESP,7,IS,S,IFERR,1)
C
C    RESP : D.F.T. OF RESP, NPTS = 256, T(RESP) =0.1333SEC,
C    CRESP : COMPLEX EQUIVALENT OF RESP.
C
      DO 41 I=1,128
41      CRESP(I)=CRESP(I)*(T/2)
      WRITE(6,25)RESP
25    FORMAT(16F8.4)
C
C    CRESP : RESPONSE IN FREQUENCY DOMAIN IS D.F.T.
C    OF IMPULSE RESPONSE DIVIDED BY A FACTOR OF 2/T, T(RESP)=256/SPS
C    CRESP IN D.U./MICRON/SEC.
C
C     NOR = ORDER OF THE POLYNOMIAL FOR FILTERING.
C     WL : CUT OF FREQUENCY.
C     IFIL> 0 APPLY LOW PASS FILTER.
C    NFILES = TOTAL NO OF FILES(= EVENTS).
C
      JFR=128
      READ(5,120) NFILES,IFIL,NOR,WL
120   FORMAT(I5,I1,I4,F5.0)
      IF(IFIL) 18,18,17
17    CALL BLFIL(B,NOR,WL,JFR,P,T)
      IRS=0
       CALL ORSH(IRS,XINC,XOT,&999)
      CALL RRITE(B,' FILT RESP   ','   LOW PASS 40HZ')
      CALL ORSH(IRS,XINC,XOT,&999)
      CALL RRITE(PAT,' % ATTEN.     ','     PER CENTAGE ')
18    IRS=1
        DO 1 NEV =1,NFILES
      READ(5,121) NFIL,GAIN,KSKIP,NSKIP,NTOT,COMP
121   FORMAT(I5,F5.3,I5,I2,I5,A2)
      IF (NTOT.EQ.0) NTOT=256
      WRITE(6,19) NFIL,COMP
19    FORMAT('1',T50,'FILE NUMBER ',I4,/,T50,16('*'),T100,
     *'COMPONENT = ',A2)
      WRITE(6,16) NSKIP,KSKIP
16    FORMAT('  NO. OF BLOCKS SKIPPED (1024 SAMPLES/BLOCK) = ',I2,/,
     *'  NO. OF SAMPLES SKIPPED IN THE NEXT BLOCK = ',I5,/)
      CALL ORSH(IRS,XINC,XOT,&999)
      CALL SYMBOL(0.0,5.0,0.6,' FILE NO.',90.0,9)
      VEN=FLOAT(NFIL)
      CALL NUMBER(0.0,11.0,0.6,VEN,90.0,-1)
      XOT=2.0
      IRS=-1
      CALL PLOT(XOT,0.,-3)
      CALL READT (F,NEV,KSKIP,NSKIP,NTOT)
C     READ(5,125) (F(K),K=1,NTOT)
125   FORMAT(16F5.0)
C
C    F : RAW SEISMOGRAM IN D.U., SAMPLED AT 'SPS' SAMPLES/SEC
C   GAIN = FACTOR TO NORMALIZE RAW DATA TO GAINS 1:REC. 50:REP.
C   REC GAINS W.R.T. GAIN 1 ARE AS FOLLOWS:  2=*1.45 3=*4.18 4=*18.18
C   5=*55.0 6=*177.7 7=*455  REP GAINS ARE ABSOLUTE.(E.G. 100 = *100)
C          E.G. IF REC=1 & REP=100 THEN GAIN =0.5
C
      DC=0.
      DO 2 I=1,256
2     DC=DC+F(I)
      DC=DC/256.
      WRITE(6,20)GAIN,DC
20    FORMAT(' GAIN:',F8.4,', DC REMOVED',F8.0)
```

SPEC-2 Sub RRITE Sub ORSH

```
      DO 3 I=1,256
3     F(I)=(F(I)-DC)*GAIN
      DO 4 I=1,9
      F(I)=F(I)*TAPE(I)
      II=257-I
4     F(II)=F(II)*TAPE(I)
C
C    F : SEISMOGRAM IN D.U., GAINS 1 & 50, WINDOWED WITH COSINE BELL.
C
      CALL ORSH(IRS,XINC,XOT,&999)
      CALL RRITE(F,' RAW DATA   ',' D.U.,GAINS 1&50')
      CALL RHARI(F,7,IS,S,IFERR,2)
C
C    F : D.F.T. OF SEISMOGRAM, GAINS 1 & 50, NPTS = 256, T = 256/SPS SEC.
C    CF : COMPLEX EQUIVALENT OF F.
C
      IRS=0
      XOT=0.0
      CALL ORSH(IRS,XINC,XOT,&999)
      CALL RRITE(F,' TRANSFORM  ','FREQ. DOMAIN    ')
C     DECONVOLUTION OF DATA BY SYSTEM RESPONSE  CRESP.
      DO 5 I=1,129
      CF(I)=CF(I)*CRESP(I)
      IF(IFIL.GT. 0) CF(I)=CF(I)*B(I)
5     SPEC(I)=ALOG10(CABS(CF(I))/(I*TCON))
      IF(IFIL.EQ 0) GO TO 8
      CALL ORSH(IRS,XINC,XOT,&999)
      CALL RRITE(F,' FILT. TRANS',' FREQ. DOMAIN  ')
C   FF  IS FILTERED RAW DATA.
      DO 49 K=1,256
49    FF(K)=F(K)
      CALL RHARI (FF,7,IS,S,IFERR,-2)
      CALL ORSH(IRS,XINC,XOT,&999)
      CALL RRITE(FF,' FILT RAW D ',' TIME DOMAIN    ')
C
C    CF : D.F.T. OF GROUND VELOCITY IN MICRONS/SEC, NPTS=256,T = 256/SPS SEC.
C    F : REAL EQUIVALENT OF CF.
C    SPEC : AMPLITUDE SPECTRAL DENSITY IN MICRON-SEC.
C   TCON = 4*PI/(T**2) = 4*PI*(SPS/256)**2
C
C   SCALING OF AMPLITUDE SPECTRAL PLOT.
C   REDUCES 1ST HARMONIC BY 'RAT' IF AMP. OF 1ST IS >DC BY 2.0
8       SPEC(129)=AMAX1(SPEC(2),SPEC(3),SPEC(4))
      RAT=10.**(SPEC(1)-SPEC(129))
      IF(RAT-2.0)51,51,50
50    F(3)=F(3)/RAT
      F(4)=F(4)/RAT
51    SPEC(130)=0.2
      SS=SPEC(129)
      ISS=IFIX(SS)
      SS=FLOAT(ISS)
      SPEC(.29)=SS
      F(1)=0.
      CALL RHARI (F,7,IS,S,IFERR,-2)
C
C    F : GROUND VELOCITY IN MICRONS/SEC,SAKPLED AT 'SPS' SAMPLES PER SEC.
C   DC & FUNDEMENTAL OVE  256/SPS SECS REMOVED.
C
      IRS=1

      CALL ORSH(IRS,XINC,XOT,&999)
      CALL RRITE(F,' VELOCITY   ',' MICRONS/SEC.   ')
      IRS=0
      F(1)=0.
      EN(1)=0.
      DO 6 I=2,256
      EN(I)=EN(I-1)+(F(I)**2)/SPS
6     F(I)=F(I-1)+F(I)/SPS
C
C    F : GROUND DISPLACEMENT IN MICRONS, AT 'SPS' SAMPLES/SEC..
C    EN : INTEGRAL OF VEL**2 OVER TIME (IN MICRONS**2/SEC),
C           AT 'SPS' SAMPLES PER SECOND.
      CALL ORSH(IRS,XINC,XOT,&999)
C
      CALL RRITE(F,' DISP       ',' MICRONS         ')
      CALL ORSH(IRS,XINC,XOT,&999)
      CALL RRITE(EN,' ENERGY     ',' MICRONS**2/SEC.')
      IRS=1
      XOT=18
      CALL ORSH(IRS,XINC,XOT,&999)
      CALL PSPEC(SPEC,XOT)
      IRS=-1
1     XOT=0 0
999   CALL PLOT(0.0,0.0,999)
      STOP
      END
      SUBROUTINE RRITE(F,A,B)
      DIMENSION F(258),G(258),A(3),B(4)
      COMMON TIME(258)
      CALL SCALE(F,6.,256,1,10.)
      CALL AXIS(0.,0.,A,12,5.,90.,F(257),F(258),10.)
      CALL LINE(TIME,F,256,1,0,0)
C  PLOT OF TIME OR FREQUENCY AXIS.
C  PLOTS A TICK EVERY 25 UNITS
      S25=(1/TIME(258))*25
      TIC=0.0
      CALL PLOT(0.0,0.0,3)
      DO 2 J=1,256,25
      CALL PLOT(TIC,0.0,2)
      CALL PLOT(TIC,-0.2,2)
      VAL=FLOAT(J-1)
      CALL NUMBER(TIC,-0.5,0.2,VAL,0.,-1)
      CALL PLOT(TIC,0.0,3)
2     TIC=TIC+S25
      NN=IFIX(ALOG10(F(258)*1.0E10))-10
      FAC=10.**NN
      DO 1 I=1,258
1     G(I)=F(I)/FAC
      WRITE(6,20)A,G
20    FORMAT(/,3A4,/,(16F8.2))
      WRITE(6,21)NN,B
21    FORMAT(' *10.**',I2,4A4)
      RETURN
      END
      SUBROUTINE ORSH (IRSET,XINC,XOTHR,*)
C   ORSH  SHIFYS ORIGIN OF PLOTTER TO A NEW POSITION AT XO & YO CMS
C          FROM PREVIOUS ORIGIN.
C      YIP/XIP ARE THE INCREASE OF THE ORIGIN POSITION FROM THE LEFT
C            BOTTOM CORNER OF THE PLOTTER/PAPER.
```

SPEC - 3 Sub ORSH Sub READT Sub PSPEC

```
C    XMAX/YMAX : MAX. DISTANCES ALONG THE PLOTTER X & Y AXIS.
C    IRSET < 0 :START A NEW SET OF PLOTS AT PREVIOUS ORIGIN.
C          = 0 :CONTINUE ABOVE PREVIOUS PLOT.
C          > 0 :RETURN TO BOTTOM OF PAPER FOR NEXT PLOT.
C    XOTHR =INCREASE IN X ORIGIN IF RESET EXTERNALLY.
C       XINC : INCREMENT ALONG X AXIS,DEFINES ITS
C                                                A PLOT LENGTH.
          XO=0.0
          X=X+XOTHR
          XIP =XINC+1.5
          YMAX=24.0
          XMAX=300
          IF(IRSET) 10,11,12
 10           YIP=0.0
          YO=0.0
          GO TO 1
 12       YO=-YIP
          XO=XIP
          YIP=0.0
          X=X+XO
          GO TO 1
 11       YO=6.C
          YIP=YO+YIP
          IF(YIP.LT.YMAX) GO TO 1
          YIP=YIP-YO
          YO=-YIP
          YIP=0.0
          XO=XIP
          X=X+XO
 1        IF(X.LT.XMAX) GO TO 2
          WRITE(6,66) XMAX
 66       FORMAT(5X,'***** MAX. X-DISTANCE OF ',F5.0,'CMS EXCEEDED ON ',
         *'PLOTTER',/,T10,'PROG. TERMINATED DURING THIS FILE ')
          RETURN 1
 2        CALL PLOT(XO,YO,-3)
          YO=ABS(YO)
          RETURN
          END
```

```
          SUBROUTINE READT(X,JJ,K,NSKIP,NTOT)
C   THIS SUBROUTINE READS A FILE FROM A TAPE.
C   THE FILES ARE READ IN THE ORDER OF THE //GO.FT00F000 STATMENTS.
          REAL*4 X(50500)
          REAL*4 OUT(1024)
          CALL ERRSET(212,256,256)
          CALL ERRSET(218,256,256)
C               JJ= FILE NUMBER  I.E. //FT13F00JJ
C                 K= NO. OF SAMPLES TO BE SKIPPED IN THE FIRST BLOCK TO BE READ.
C             NSKIP= NO. OF BLOCKS TO BE SKIPPED FROM THE BEGINNING OF THE FILE.
C              NTOT= TOTAL NO. OF SAMPLES TO BE READ.
C                      ( 1 BLOCK = 1024 SAMPLES)
          N=0
C   READS BLOCKS THAT ARE TO BE SKIPPED.
          NSK=NSKIP+1
          DO 9 I=1,NSK
  9       READ(13,END=4,ERR=6) OUT
          GO TO 200
 4        IF(N.NE.0) GO TO 1
          WRITE(6,100)JJ
 100      FORMAT(50X,'FILE NO=',I5,5X,'EMPTY FILE')
          GO TO 1
  6       M=N+1
          WRITE(6,101)JJ,M
   101    FORMAT(//,50X,'FILE NO=',I5,5X,'ERROR BLOCK=',I5,/)
          GO TO 9
 200      N=N+1
          IF(N.GT.1) GO TO 600
          MM=0
          DO 700 I=K,1024
          MM=MM+1
          IF(MM.EQ.NTOT) GO TO 5
  700     X(MM)=OUT(I)
          GO TO 9
  600     DO 5 I=1,1024
          MM=MM+1
          IF(MM.GE.NTOT) GO TO 10
      5    X(MM)=OUT(I)
          GO TO 9
C         READ REMAINING BLOCKS OF CURRENT FILE WHICH HAVE NOT BEEN USED
   10     DO 1000 I=1, 50
  1000    READ(13,END=1,ERR=1)OUT
 1         RETURN
          END
```

```
          SUBROUTINE PSPEC(SPEC,XOT)
          DIMENSION SPEC(130),SPL(128),XLOG(130)
C       PSPEC PLOTS THE SPECTRUM OF 1 TO 128HZ ON A LOG LOG AXIS OF 5CM/DECADE.
C                 I.E. XLOG(130)=0.2 LOG UNITS PER CM.
          CALL PLOT(0.0,20.0,-3)
          DO 1 I=1,128
 1        XLOG(I)=ALOG10(FLOAT(I))
          XLOG(129)=0.0
C   A SETS THE START OF THE VERT LOG AXIS SCALE AT 4+3/5  DECADES FROM THE ORIG.
          A=2.51189*(10**(SPEC(129)-5.0))
            AL=ALOG10(A)
            DO 2 I=1,128
            SPL(I)=SPEC(I)
```

SPEC-4 Sub PSPEC

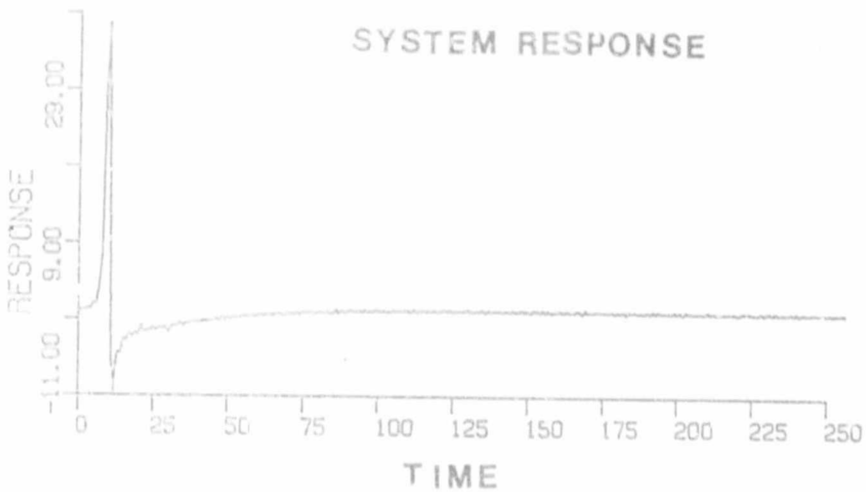
```
          IF(SPEC(I).LT.AL) SPEC(I)=AL+0.05
   2      CONTINUE
        B=SPEC(130)
        XLOG(130)=0.2
        CALL LGAXS(0.,-23.,' LOG AMP(DISPL) SPECTRUM.',25,28.0,90.,
       *A,B)
        CALL LGAXS(15.,-23.,' ',-1,28.0,90.,A,B)
        A=1.0
        B=XLOG(130)
        CALL LGAXS(0.,5.,' ',1,15.,0.,A,B)
        CALL LGAXS(0.,-23.,'LOG FREQUENCY',-13,15.,0.,A,B)
        CALL LINE(XLOG,SPEC,128,1,-1,1)
        WRITE(6,22)SPL,SPEC(129),SPEC(130)
  22    FORMAT('0LOG AMPLITUDE SPECTRAL DENSITY (MICRON-SEC.)',/,
       *(16F8.2))
        CALL PLOT(XOT,-20.,-3)
        RETURN
        END
//LKED.SYSLIN DD
  INCLUDE       DD1(HWBRH291)
//DD1           DD   DSN=ACM..XN006.LOAD,DISP=SHR
//GO.PLOTAXYZ DD DSN=&&NULLFILE
//GO.PLOTASQX DD UNIT=PLOTOUT,SPACE=(CYL,(3,3))
//GO.FT13F001 DD UNIT=TAPE,VOL=SER=ARFWEL,DCB=(RECFM=VBS,LRECL=2052,
// BLKSIZE=2048),LABEL=(083,,,OUT),DSN=FILE083,DISP=(NEW,PASS)
//GO.FT13F002 DD UNIT=TAPE,VOL=SER=ARFWEL,DCB=(RECFM=VBS,LRECL=2052,
// BLKSIZE=2048),LABEL=(086,,,OUT),DSN=FILE086,DISP=(NEW,PASS)
//GO.FT13F003 DD UNIT=TAPE,VOL=SER=ARFWEL,DCB=(RECFM=VBS,LRECL=2052,
// BLKSIZE=2048),LABEL=(125,,,OUT),DSN=FILE125,DISP=(NEW,PASS)
//GO.FT13F004 DD UNIT=TAPE,VOL=SER=ARFWEL,DCB=(RECFM=VBS,LRECL=2052,
// BLKSIZE=2048),LABEL=(134,,,OUT),DSN=FILE134,DISP=(NEW,PASS)
//GO.FT13F005 DD UNIT=TAPE,VOL=SER=ARFWEL,DCB=(RECFM=VBS,LRECL=2052,
// BLKSIZE=2048),LABEL=(135,,,OUT),DSN=FILE135,DISP=(NEW,PASS)
//GO.SYSIN DD *
   16   20   37   44  102  111  330  730 3055 3772 -617-1040 -525 -543 -355 -363
 -286 -316 -277 -284 -183 -255 -242 -239 -212 -239 -207 -213 -207 -265 -199 -169
 -189 -136 -173 -143 -147 -136 -130 -129 -120 -108 -109 -107 -112  -85  -98  -81
  -87  -72  -86  -66  -69  -67  -47  -49  -47  -42  -48  -38  -36  -37  -30  -35
  -31  -26  -16  -27  -28   -9   -7  -19  -12  -12   -1    4   -2    2   -9    9
         -6   22   -3  -13   43  -12   24    2   15   25   19    6   20    6   34
   13    9   23   36   12   25   11   12   26   20   22   21   25   33    1   44
   16   23   33   20   27   20   27   15   20   35   19   30   20   20   23   16
   22   40   25   10   26   21   35    7   26   14   25   27   18   21   31   11
   26   19   18   35   23   21    3   32   34    2   37   12   32    5   18   13
   31    6   23   10    3   27   34  -11   34   16    8   16   22   22   10   13
    5   21    5   15    5   25   -7   19   10   21    1   12    3   19    0   23
    7   23    5   13   11   -3   25    1   19  -14   28   10    8    1   13    4
   -6   25    5   10   -1    0   11    6   11    1   11   -6   -4   20    5    9
    8    2   -7   21  -11    8   19   -6   15   -2   -1    2   -3   18   -6   15
  -12    4    5   -3    8   13   -1   -9    5  -10    5   -2    3   -1    6    0
 .024 .095 .206 .345 .500 .655 .794 .905 .972
    5
    630.345  674 2      N
    860.045  468 1      V
   1250.006  949 1
   1340.014 1003 0      Y
   1350.014  140 2      E
//
```

System Response

Cosine Taper

Data

Example J.C.L. & Data included



O V E R L A Y S

FIGURES A1-1 to A1-7

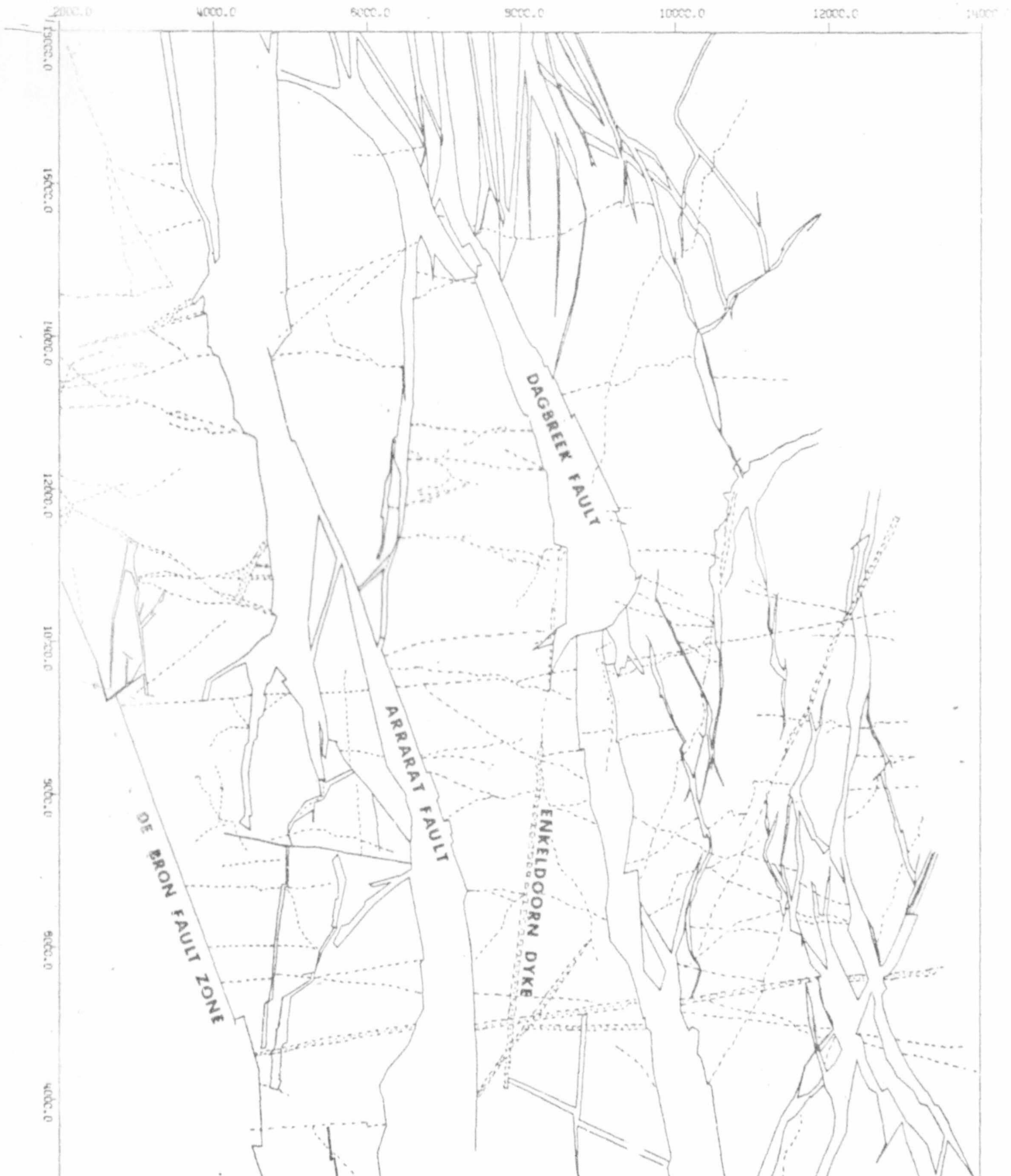

DAGBREEK FAULT
ARRARAT FAULT
ENKELDOORN DYKE
DE BRON FAULT ZONE
2000.0
4000.0
6000.0
8000.0
10000.0
12000.0

Figure A1-1

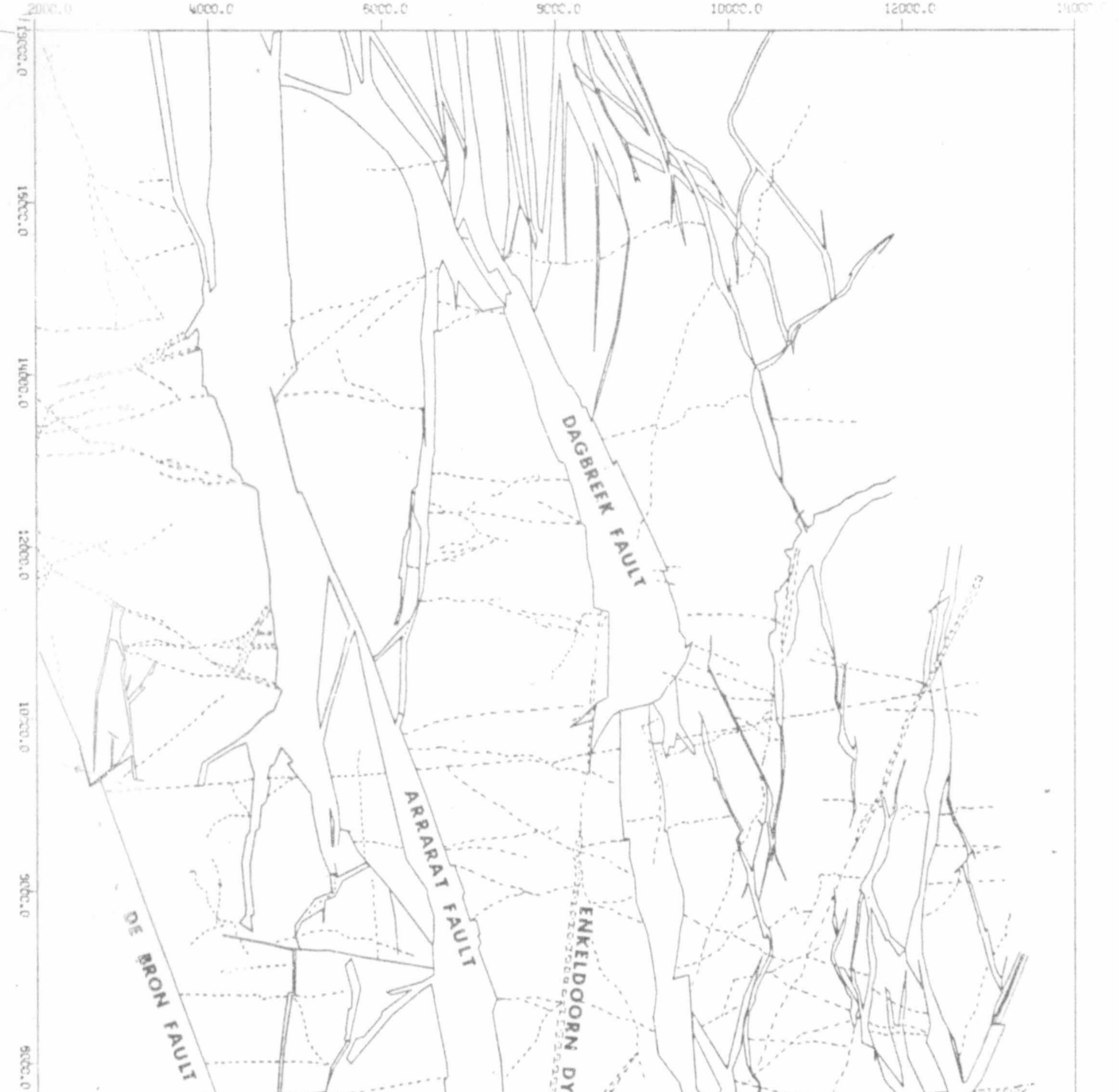

2000.0
4000.0
6000.0
8000.0
10000.0
12000.0
16000.0
14000.0
12000.0
10000.0
8000.0
6000.0
4000.0
2000.0
DAGBREEK FAULT
ARRARAT FAULT
ENKELDOORN DYKE
DE BRON FAULT ZONE

Figure A1-1

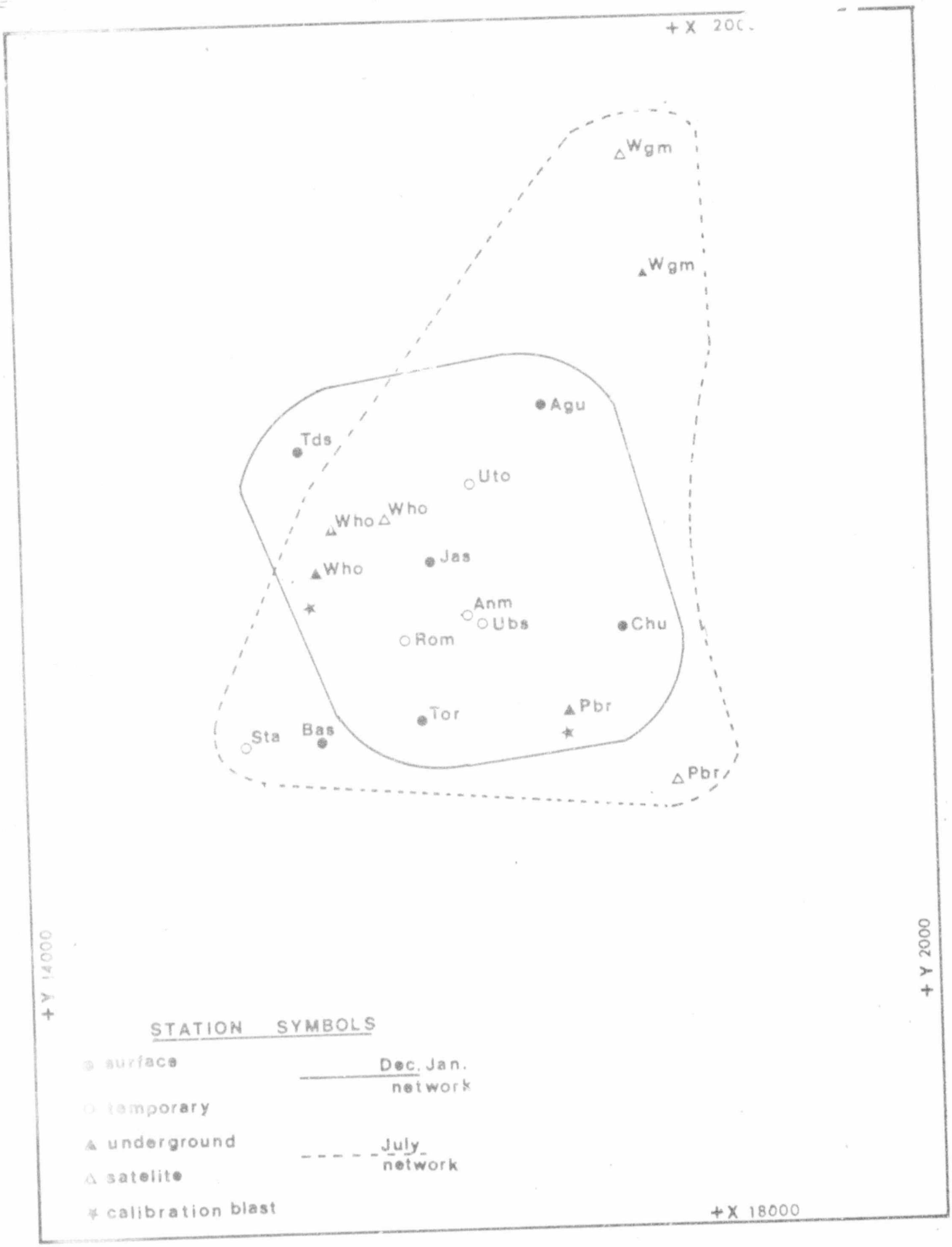

+X 200
Wgm
Wgm
Agu
Tds
Uto
Who
Who
Who
Jas
Anm
Ubs
Chu
Rom
Tor
Pbr
Sta
Bas
Pbr
+Y 14000
+Y 2000
STATION SYMBOLS
surface
temporary
underground
satelite
calibration blast
Dec. Jan. network
July network
+X 18000

Figure A1-2

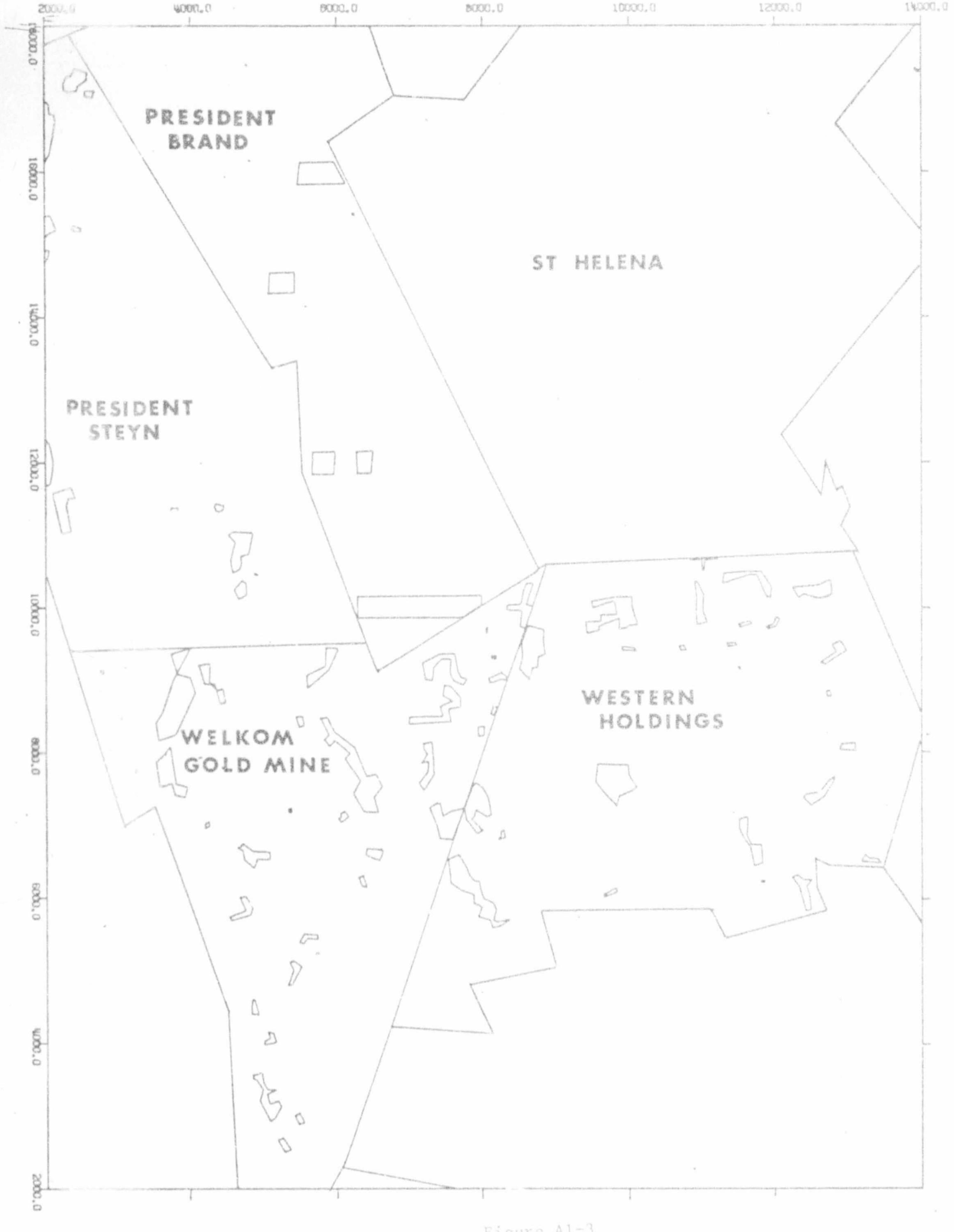

2000.0
4000.0
6000.0
8000.0
10000.0
12000.0
14000.0
18000.0
16000.0
14000.0
12000.0
10000.0
8000.0
6000.0
4000.0
2000.0
PRESIDENT
BRAND
ST HELENA
PRESIDENT
STEYN
WESTERN
HOLDINGS
WELKOM
GOLD MINE

Figure A1-3

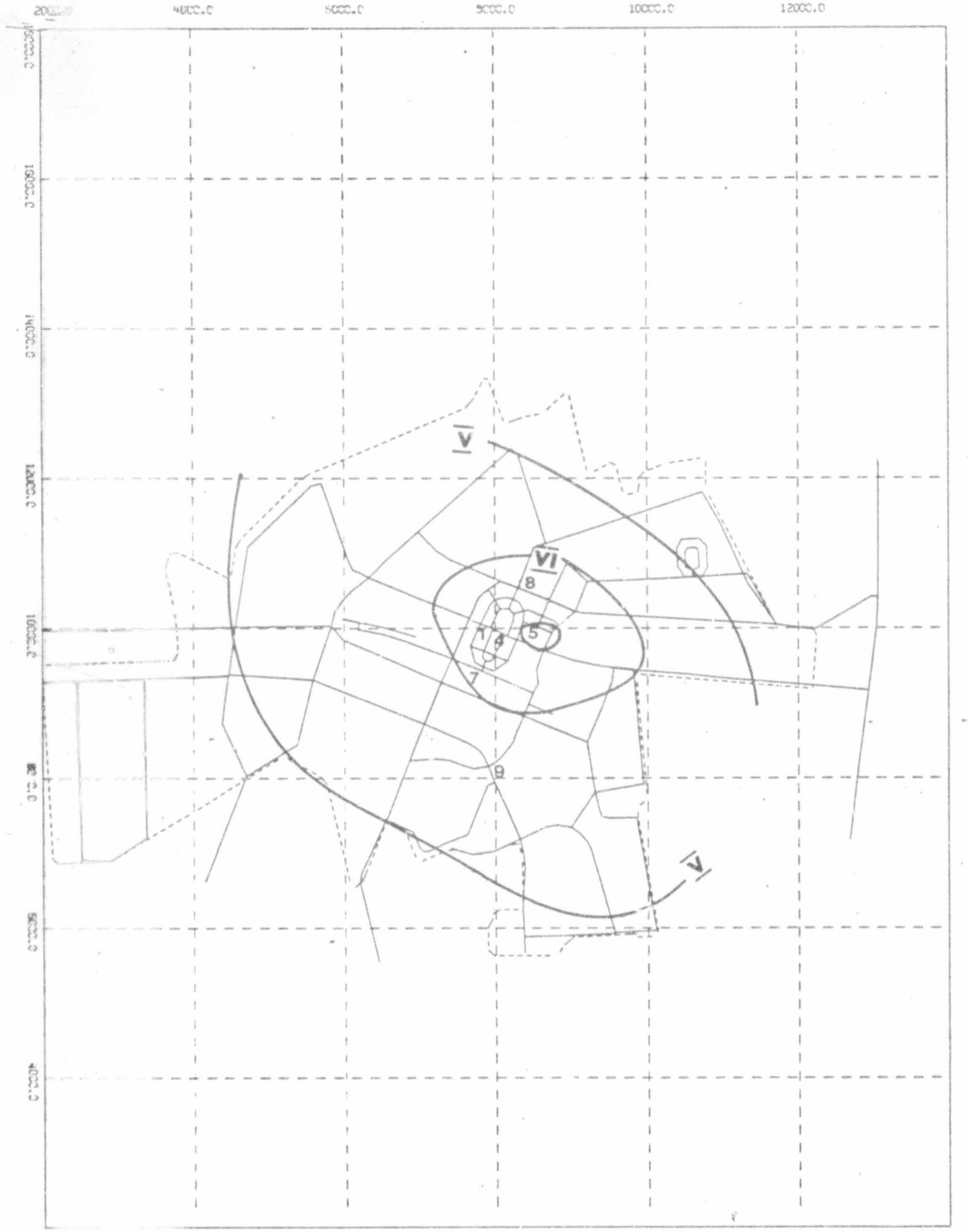


Figure A1-4

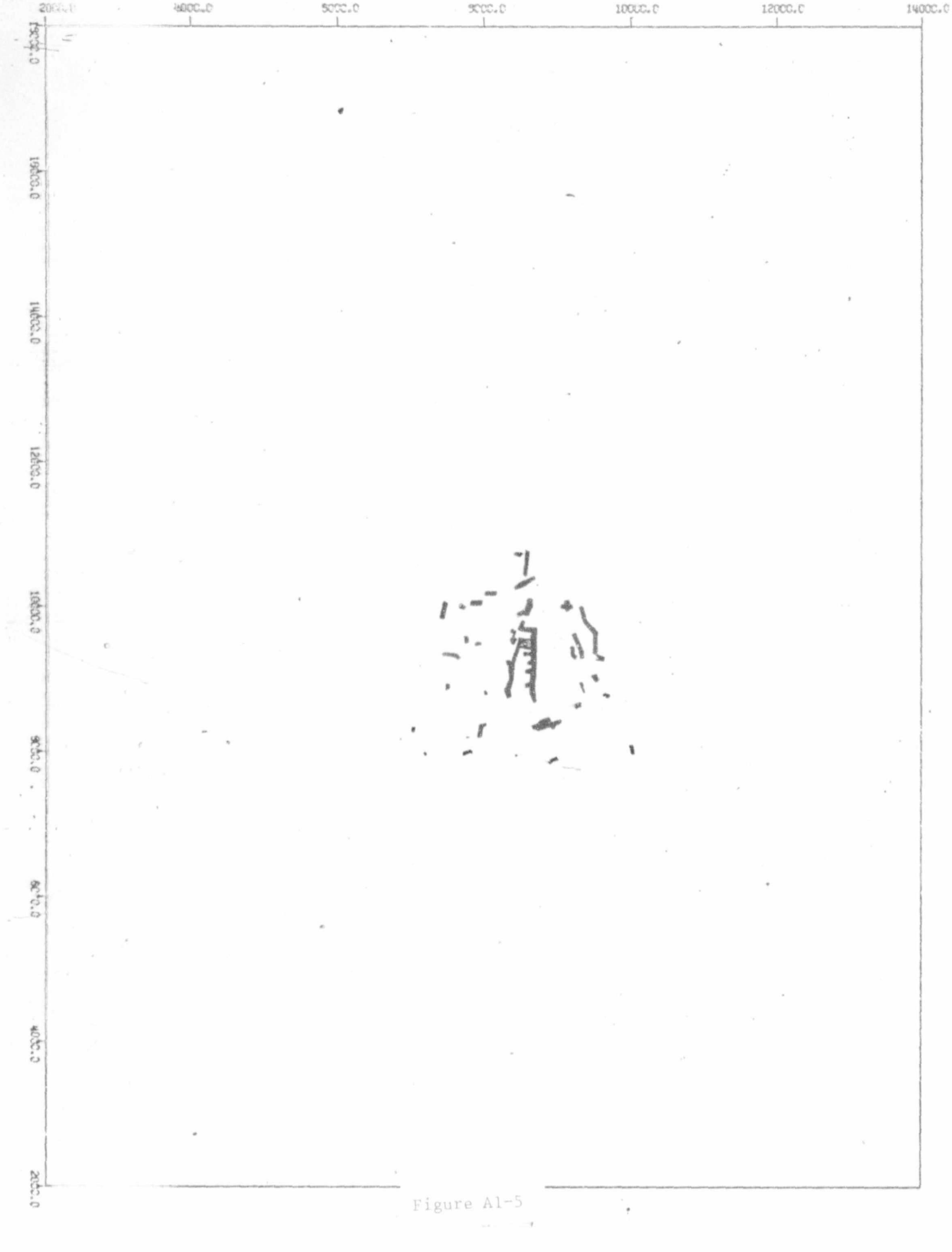


Figure A1-5

I.F.S GOLDFIELDS SEISMICITY DEC. 1976/JAN. 1977.

DEPTH SYMBOLS

<1.5 2.0 2.5 3.5 4.5 >4.5

SCALE = 1: 20000 PLOT REDUCED BY : 0.30

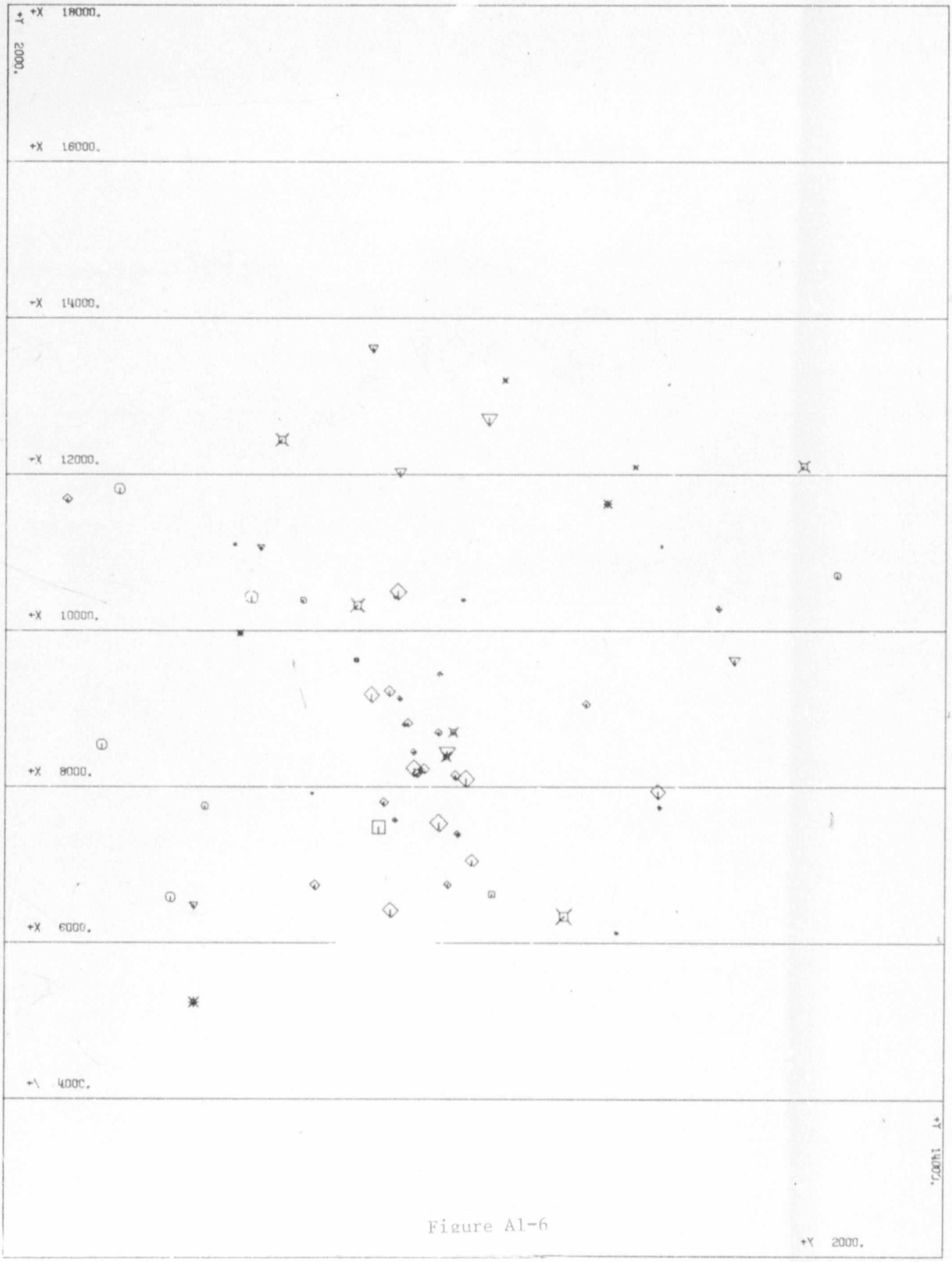


Figure A1-6

O.F.S GOLDFIELDS SEISMICITY JULY 1977

DEPTH SYMBOLS

<1.5 2.0 2.5 3.5 4.5 >4.5

SCALE = 1: 20000 PLOT REDUCED BY : 0.30

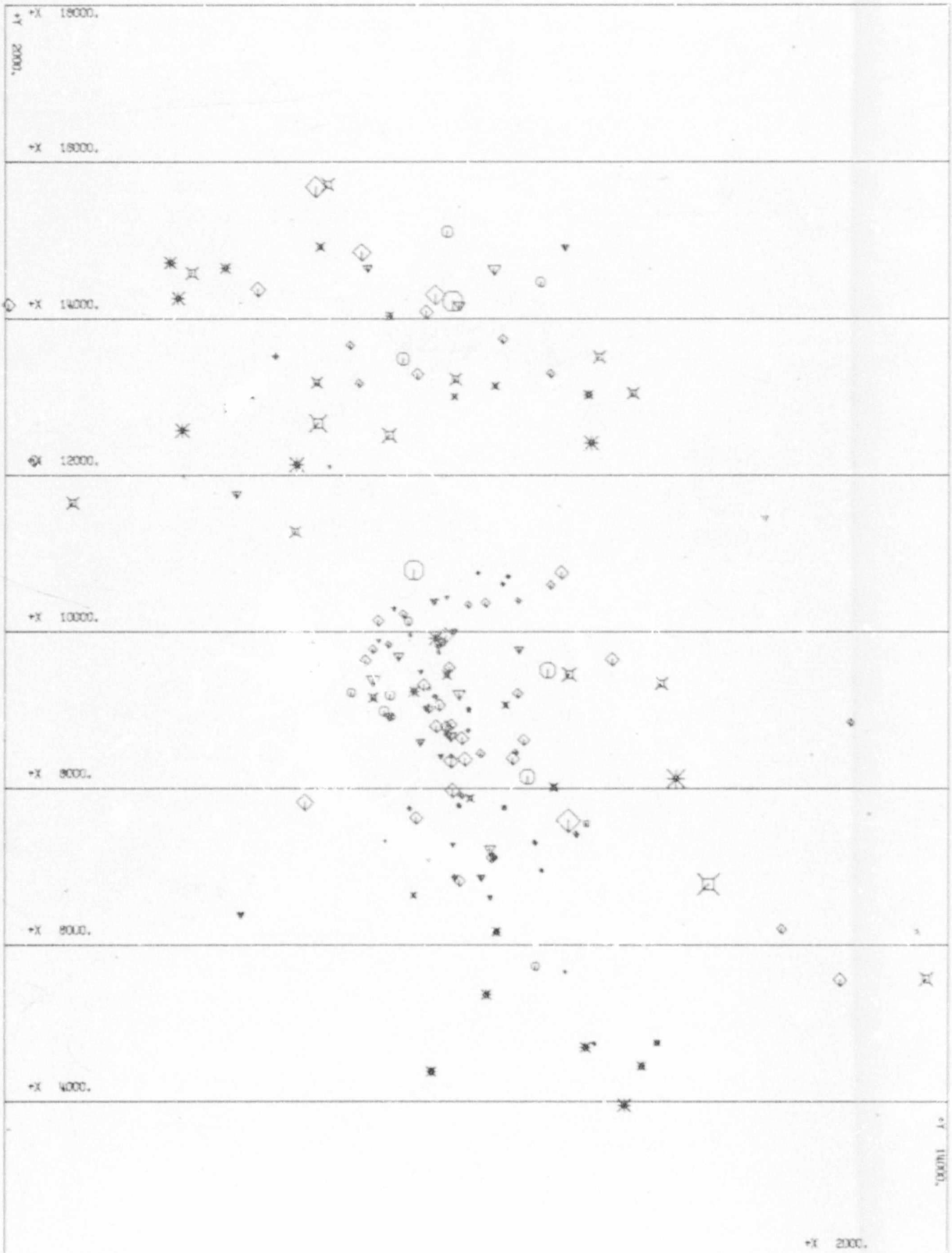


Figure A1-7