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Seismicity in the Welkom Area, O.F.S. (with special reference to the origin of the 1976-12-8 event)

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Pgm SPEC-I File SSPECD

```
//AKFSPC25 JOB 006,BPI,MSGLEVEL=(0,0),CLASS=B
/*ROUTE  PRINT RCLO
/*SETUP  *  TAPE=(ARFMEL SL, NO RING)
/*JOBPARM R=0,B
//   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 (3.48SEC),
C  AND THEN CORRECTED FOR INSTRUMENT RESPONSE AND EDGE EFFECTS.
C  THE DISPLACEMENT SPECTRA IS THEN OBTAINED FROM THE TAPATED 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(126),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,4999)
      CALL WRITE(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 RHARI(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(8,NOR,WL,JFR,P,T)
      IRS=0
      CALL ORSH(IRS,XINC,XOT,4999)
      CALL WRITE(8,' FILT RESP  ',' LOW PASS 40HZ')
      CALL ORSH(IRS,XINC,XOT,4999)
      CALL WRITE(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,4999)
      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

```
L.0114        DO 3 I=1,256
L.0115 3      F(I)=(F(I)-DC)*GAIN
L.0116        DO 4 I=1,9
L.0117        F(I)=F(I)*TAPE(I)
L.0118        II=257-I
L.0119 4      F(II)=F(II)*TAPE(I)
L.0120 C
L.0121 C      F : SEISMOGRAM IN D.U., GAINS 1 & 50, WINDOWED WITH COSINE BELL.
L.0122 C
L.0123        CALL ORSH(IRS,XINC,XOT,&999)
L.0124        CALL RRITE(F,' RAW DATA   ',' D.U.,GAINS 1&50')
L.0125        CALL RHAR1(F,7,IS,S,IFERR,2)
L.0126 C
L.0127 C      F : D.F.T. OF SEISMOGRAM, GAINS 1 & 50, NPTS = 256, T = 256/SPS SEC.
L.0128 C      CF : COMPLEX EQUIVALENT OF F.
L.0129 C
L.0130        IRS=0
L.0131        XOT=0.0
L.0132        CALL ORSH(IRS,XINC,XOT,&999)
L.0133        CALL RRITE(F,' TRANSFORM  ',' FREQ. DOMAIN    ')
L.0134 C      DECONVOLUTION OF DATA BY SYSTEM RESPONSE  CRESP.
L.0135        DO 5 I=1,129
L.0136        CF(I)=CF(I)*CRESP(I)
L.0137        IF(IFIL.GT. 0) CF(I)=CF(I)*B(I)
L.0138 5      SPEC(I)=ALOG10(CABS(CF(I))/(I*TCON))
L.0139        IF(IFIL.EQ 0) GO TO 8
L.0140        CALL ORSH(IRS,XINC,XOT,&999)
L.0141        CALL RRITE(F,' FILT. TRANS',' FREQ. DOMAIN  ')
L.0142 C   FF : IS FILTERED RAW DATA.
L.0143        DO 49 K=1,256
L.0144 49     FF(K)=F(K)
L.0145        CALL RHAR1 (FF,7,IS,S,IFERR,-2)
L.0146        CALL ORSH(IRS,XINC,XOT,&999)
L.0147        CALL RRITE(FF,' FILT RAW D ',' TIME DOMAIN    ')
L.0148 C
L.0149 C      CF : D.F.T. OF GROUND VELOCITY IN MICRONS/SEC, NPTS=256,T = 256/SPS SEC.
L.0150 C      F : REAL EQUIVALENT OF CF.
L.0151 C      SPEC : AMPLITUDE SPECTRAL DENSITY IN MICRON-SEC.
L.0152 C   TCON = 4*PI/(T**2) = 4*PI*(SPS/256)**2
L.0153 C
L.0154 C   SCALING OF AMPLITUDE SPECTRAL PLOT.
L.0155 C   REDUCES 1ST HARMONIC BY 'RAT' IF AMP. OF 1ST IS >DC BY 2.0
L.0156 8      SPEC(129)=AMAX1(SPEC(2),SPEC(3),SPEC(4))
L.0157        RAT=10.**(SPEC(1)-SPEC(129))
L.0158        IF(RAT-2.0)51,51,50
L.0159 50     F(1)=F(1)/RAT
L.0160        F(4)=F(4)/RAT
L.0161 51     SPEC(130)=0.2
L.0162        SS=SPEC(129)
L.0163        ISS=IFIX(SS)
L.0164        SS=FLOAT(ISS)
L.0165        SPEC(.29)=SS
L.0166        F(1)=0.
L.0167        CALL RHAR1 (F,7,IS,S,IFERR,-2)
L.0168 C
L.0169 C      F : GROUND VELOCITY IN MICRONS/SEC,SAMPLED AT 'SPS' SAMPLES PER SEC.
L.0170 C   DC & FUNDAMENTAL OVER  256/SPS SECS REMOVED.
L.0171 C
L.0172        IRS=1
```

```
L.0173        CALL ORSH(IRS,XINC,XOT,&999)
L.0174        CALL RRITE(F,' VELOCITY   ',' MICRONS/SEC.    ')
L.0175        IRS=0
L.0176        F(1)=0.
L.0177        EN(1)=0.
L.0178        DO 6 I=2,256
L.0179        EN(I)=EN(I-1)+(F(I)**2)/SPS
L.0180 6      F(I)=F(I-1)+F(I)/SPS
L.0181 C
L.0182 C      F : GROUND DISPLACEMENT IN MICRONS, AT 'SPS' SAMPLES/SEC..
L.0183 C      EN : INTEGRAL OF VEL**2 OVER TIME (IN MICRONS**2/SEC),
L.0184 C           AT 'SPS' SAMPLES PER SECOND.
L.0185        CALL ORSH(IRS,XINC,XOT,&999)
L.0186 C
L.0187        CALL RRITE(F,' DISP       ',' MICRONS         ')
L.0188        CALL ORSH(IRS,XINC,XOT,&999)
L.0189        CALL RRITE(EN,' ENERGY     ',' MICRONS**2/SEC.')
L.0190        IRS=1
L.0191        XOT=10
L.0192        CALL ORSH(IRS,XINC,XOT,&999)
L.0193        CALL PSPEC(SPEC,XOT)
L.0194        IRS=-1
L.0195 1      XOT=0.0
L.0196 999    CALL PLOT(0.0,0.0,999)
L.0197        STOP
L.0198        END
L.0199        SUBROUTINE RRITE(F,A,B)
L.0200        DIMENSION F(258),G(258),A(3),B(4)
L.0201        COMMON TIME(258)
L.0202        CALL SCALE(F,6.,256,1,10.)
L.0203        CALL AXIS(0.0,0.,A,12,5.,90.,F(257),F(258),10.)
L.0204        CALL LINE(TIME,F,256,1,0,0)
L.0205 C   PLOT OF TIME OR FREQUENCY AXIS.
L.0206 C   PLOTS A TICK EVERY 25 UNITS
L.0207        S25=(1/TIME(258))*25
L.0208        TIC=0.0
L.0209        CALL PLOT(0.0,0.0,3)
L.0210        DO 2 J=1,256,25
L.0211        CALL PLOT(TIC,0.0,2)
L.0212        CALL PLOT(TIC,-0.2,2)
L.0213        VAL=FLOAT(J-1)
L.0214        CALL NUMBER(TIC,-0.5,0.2,VAL,0.,-1)
L.0215        CALL PLOT(TIC,0.0,3)
L.0216 2      TIC=TIC+S25
L.0217        NN=IFIX(ALOG10(F(258)*1.0E10))-10
L.0218        FAC=10.**NN
L.0219        DO 1 I=1,258
L.0220 1      G(I)=F(I)/FAC
L.0221        WRITE(6,20)A,G
L.0222 20     FORMAT(/,3A4,/,(16F8.2))
L.0223        WRITE(6,21)NN,B
L.0224 21     FORMAT(' *10.**',I2,4A4)
L.0225        RETURN
L.0226        END
L.0227        SUBROUTINE ORSH (IRSET,XINC,XOTHR,*)
L.0228 C   ORSH  SHIFTS ORIGIN OF PLOTTER TO A NEW POSITION AT XO & YO CMS
L.0229 C           FROM PREVIOUS ORIGIN.
L.0230 C      YIP/XIP ARE THE INCREASE OF THE ORIGIN POSITION FROM THE LEFT
L.0231 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
      XOX=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

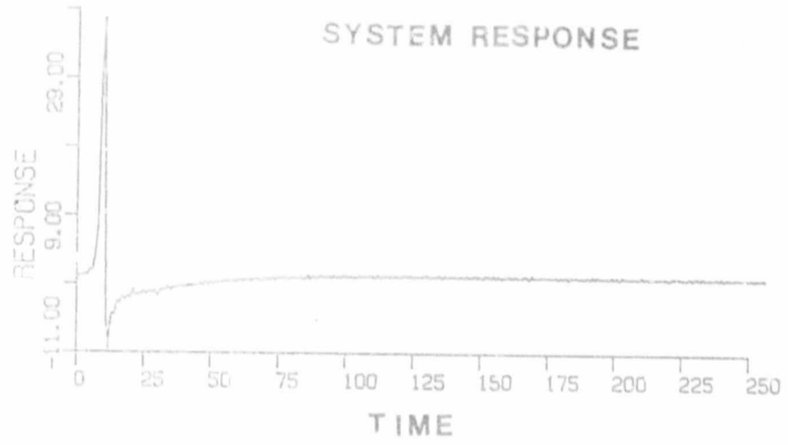
```
L.0350          IF(SPEC(I).LT.AL) SPEC(I)=AL+0.05
L.0351 2        CONTINUE
L.0352        B=SPEC(130)
L.0353        XLOG(130)=0.2
L.0354        CALL LGAXS(0.,-23.,' LOG AMP(DISPL) SPECTRUM.',25,28.0,90.,
L.0355       *A,B)
L.0356        CALL LGAXS(15.,-23.,' ',-1,28.0,90.,A,B)
L.0357        A=1.0
L.0358        B=XLOG(130)
L.0359        CALL LGAXS(0.,5.,' ',1,15.,0.,A,B)
L.0360        CALL LGAXS(0.,-23.,'LOG FREQUENCY',-13,15.,0.,A,B)
L.0361        CALL LINE(XLOG,SPEC,128,1,-1,1)
L.0362        WRITE(6,22)SPL,SPEC(129),SPEC(130)
L.0363 22     FORMAT('0LOG AMPLITUDE SPECTRAL DENSITY (MICRON-SEC.)',/,
L.0364       *(16F8.2))
L.0365        CALL PLOT(XOT,-20.,-3)
L.0366        RETURN
L.0367        END
L.0368 //LKED.SYSLIN DD
L.0369   INCLUDE       DD1(HWBRHAR1)
L.0370 //DD1           DD  DSN=ACM.MXN006.LOAD,DISP=SHR
L.0371 //GO.PLOTAXYZ DD DSN=&&NULLFILE
L.0372 //GO.PLOTASQX DD UNIT=PLOTOUT,SPACE=(CYL,(3,3))
L.0373 //GO.FT13F001 DD UNIT=TAPE,VOL=SER=ARFWEL,DCB=(RECFM=VBS,LRECL=2052,
L.0374 // BLKSIZE=2048),LABEL=(083,,,OUT),DSN=FILE083,DISP=(NEW,PASS)
L.0375 //GO.FT13F002 DD UNIT=TAPE,VOL=SER=ARFWEL,DCB=(RECFM=VBS,LRECL=2052,
L.0376 // BLKSIZE=2048),LABEL=(086,,,OUT),DSN=FILE086,DISP=(NEW,PASS)
L.0377 //GO.FT13F003 DD UNIT=TAPE,VOL=SER=ARFWEL,DCB=(RECFM=VBS,LRECL=2052,
L.0378 // BLKSIZE=2048),LABEL=(125,,,OUT),DSN=FILE125,DISP=(NEW,PASS)
L.0379 //GO.FT13F004 DD UNIT=TAPE,VOL=SER=ARFWEL,DCB=(RECFM=VBS,LRECL=2052,
L.0380 // BLKSIZE=2048),LABEL=(134,,,OUT),DSN=FILE134,DISP=(NEW,PASS)
L.0381 //GO.FT13F005 DD UNIT=TAPE,VOL=SER=ARFWEL,DCB=(RECFM=VBS,LRECL=2052,
L.0382 // BLKSIZE=2048),LABEL=(135,,,OUT),DSN=FILE135,DISP=(NEW,PASS)
L.0383 //GO.SYSIN DD *
L.0384    16   20   37   44  102  111  330  730 3055 3772 -617-1040 -525 -543 -355 -363
L.0385  -286 -316 -277 -284 -183 -255 -242 -239 -212 -239 -207 -213 -207 -265 -199 -169
L.0386  -189 -136 -173 -143 -147 -136 -130 -129 -120 -108 -109 -107 -112  -85  -98  -81
L.0387   -87  -72  -86  -66  -69  -67  -47  -49  -47  -42  -48  -38  -36  -37  -30  -35
L.0388   -31  -26  -16  -27  -28   -9   -7  -19  -12  -12   -1    4   -2    2   -9    9
L.0389     [illegible]   -6   23   -3  -13   43  -12   24    2   15   25   19    6   20    6   34
L.0390    13    9   23   36   12   25   11   12   26   20   22   21   25   33    1   44
L.0391    16   23   33   20   27   20   27   15   20   35   19   30   20   20   23   16
L.0392    22   40   25   10   26   21   35    7   26   14   25   27   18   21   31   11
L.0393    26   19   18   35   23   21    3   32   34    2   37   12   32    5   18   13
L.0394    31    6   23   10    3   27   34  -11   34   16    8   16   22   22   10   13
L.0395     5   21    5   15    5   25   -7   19   10   21    1   12    3   19    0   23
L.0396     7   23    5   13   11   -3   25    1   19  -14   28   10    8    1   13    4
L.0397    -6   25    5   10   -1    0   11    6   11    1   11   -6   -4   20    5    9
L.0398     8    2   -7   21  -11    8   19   -6   15   -2   -1    2   -3   18   -6   15
L.0399   -12    4    5   -3    8   13   -1   -9    5  -10    5   -2    3   -1    6    0
L.0400 .024 .095 .206 .345 .500 .655 .794 .905 .972
L.0401     5
L.0402    830.345  674 2      N
L.0403    860.045  468 1      V
L.0404   1250.006  949 1      V
L.0405   1340.014 1003 0      V
L.0406   1350.014  140 2      E
L.0407 //
```

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

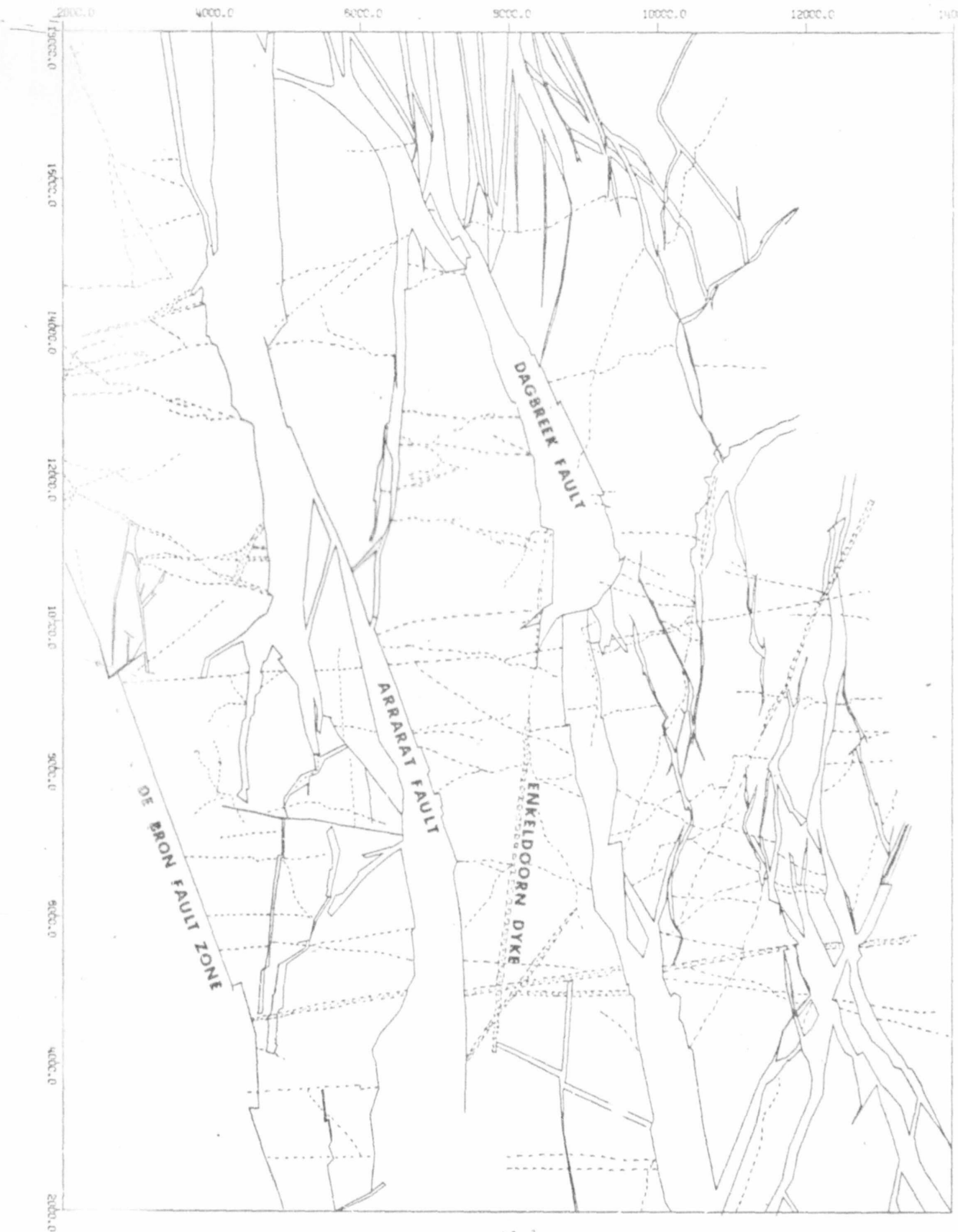

2000.0
4000.0
6000.0
8000.0
10000.0
12000.0
18000.0
16000.0
14000.0
12000.0
10000.0
8000.0
6000.0
4000.0
2000.0
DAGBREEK FAULT
ARARAT FAULT
ENKELDOORN DYKE
DE BRON FAULT ZONE

Figure A1-1


2000.0
4000.0
6000.0
8000.0
10000.0
12000.0
14000
16000.0
15000.0
14000.0
13000.0
12000.0
11000.0
10000.0
9000.0
8000.0
7000.0
6000.0
5000.0
4000.0
3000.0
2000.0
DAGBREEK FAULT
ARRARAT FAULT
ENKELDOORN DYKE
DE BRON FAULT ZONE

Figure A1-1

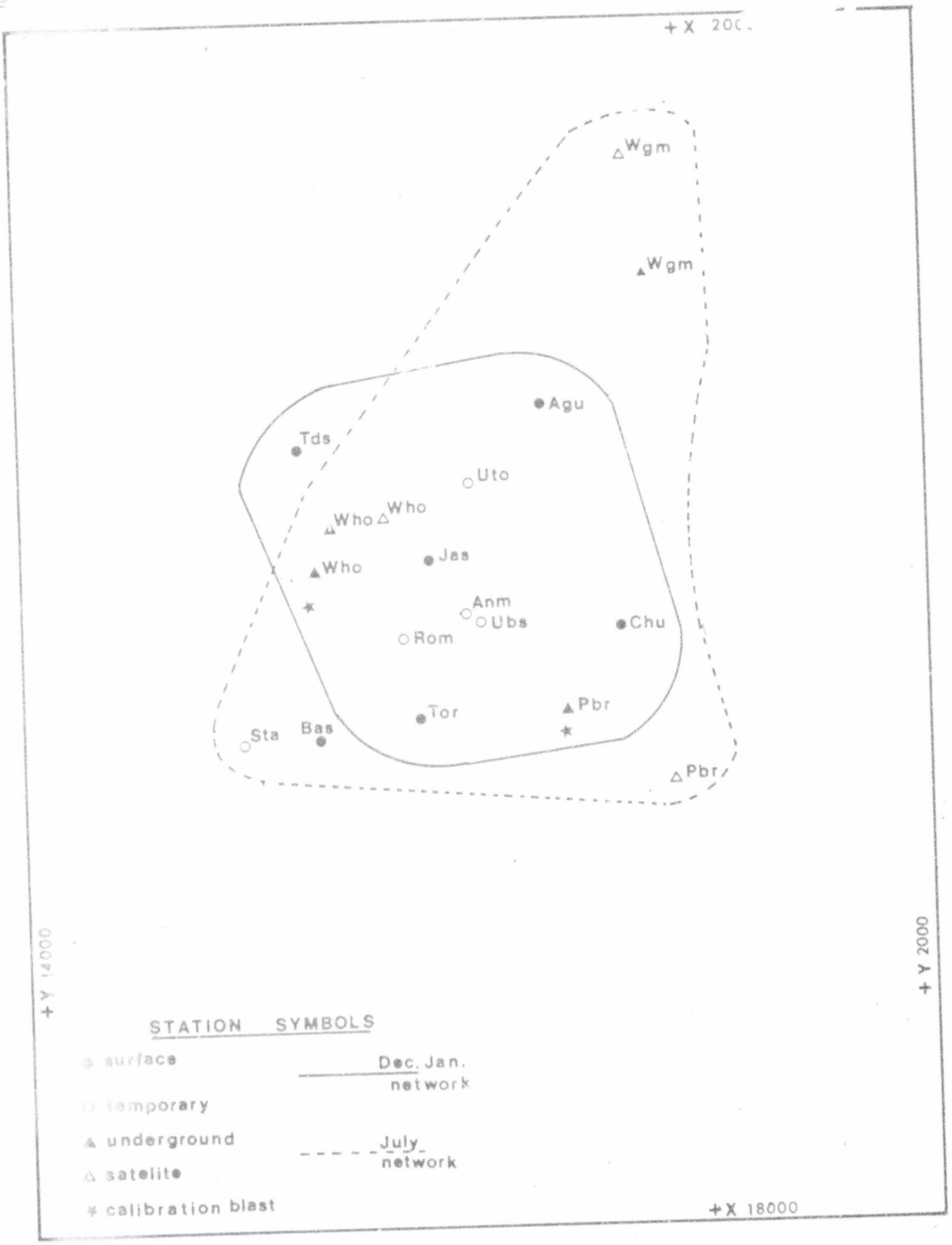

+X 200
Wgm
Wgm
Agu
Tds
Uto
Who
Who
Who
Jas
Anm
Ubs
Chu
Rom
Tor
Pbr
Sta
Bas
Pbr
+Y 14000
+Y 2000
STATION SYMBOLS
surface
temporary
underground
satelite
calibration blast
Dec. Jan. network
July network
+X 18000

Figure A1-2

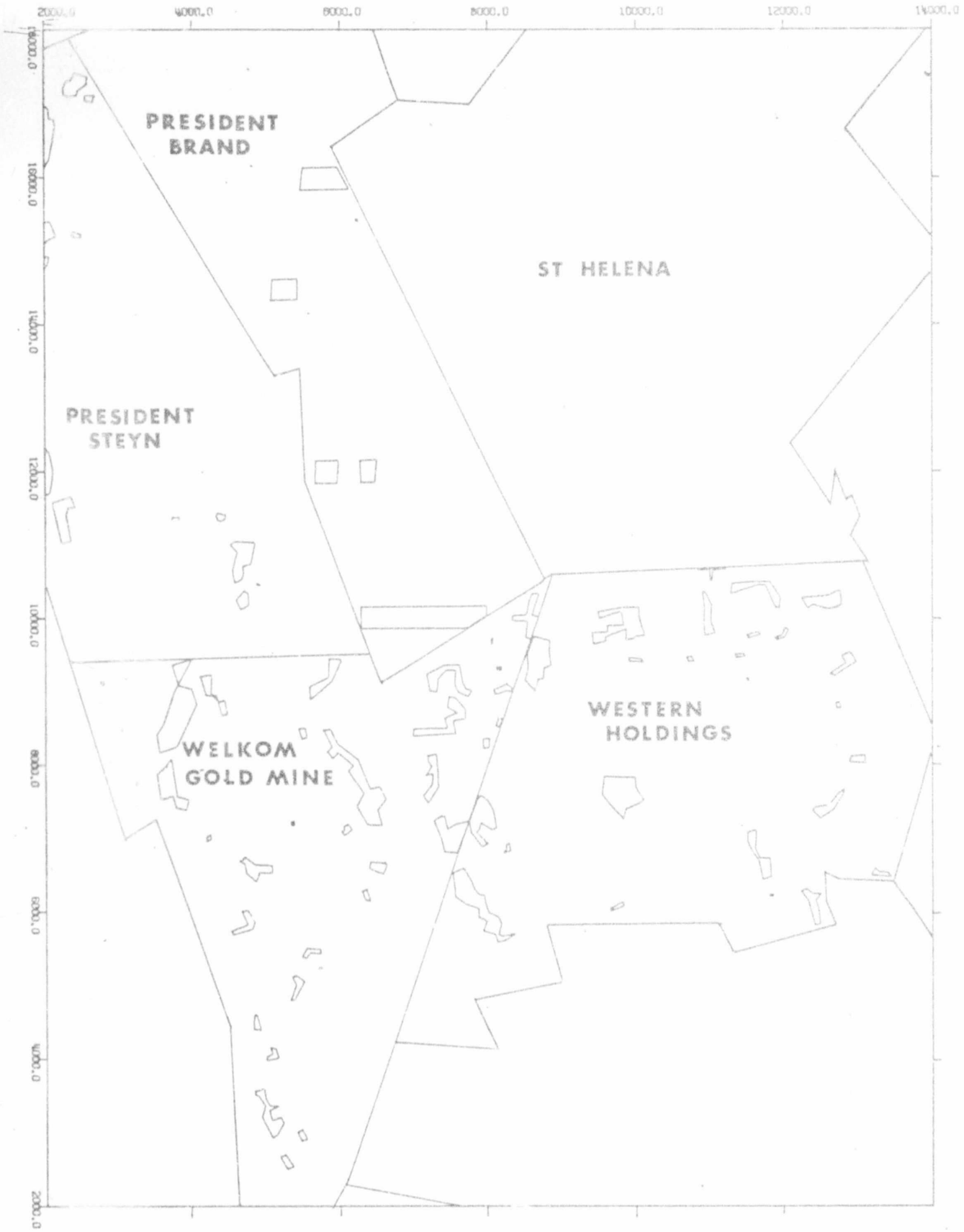

2000.0
4000.0
6000.0
8000.0
10000.0
12000.0
14000.0
PRESIDENT BRAND
ST HELENA
PRESIDENT STEYN
WELKOM GOLD MINE
WESTERN HOLDINGS

Figure A1-3

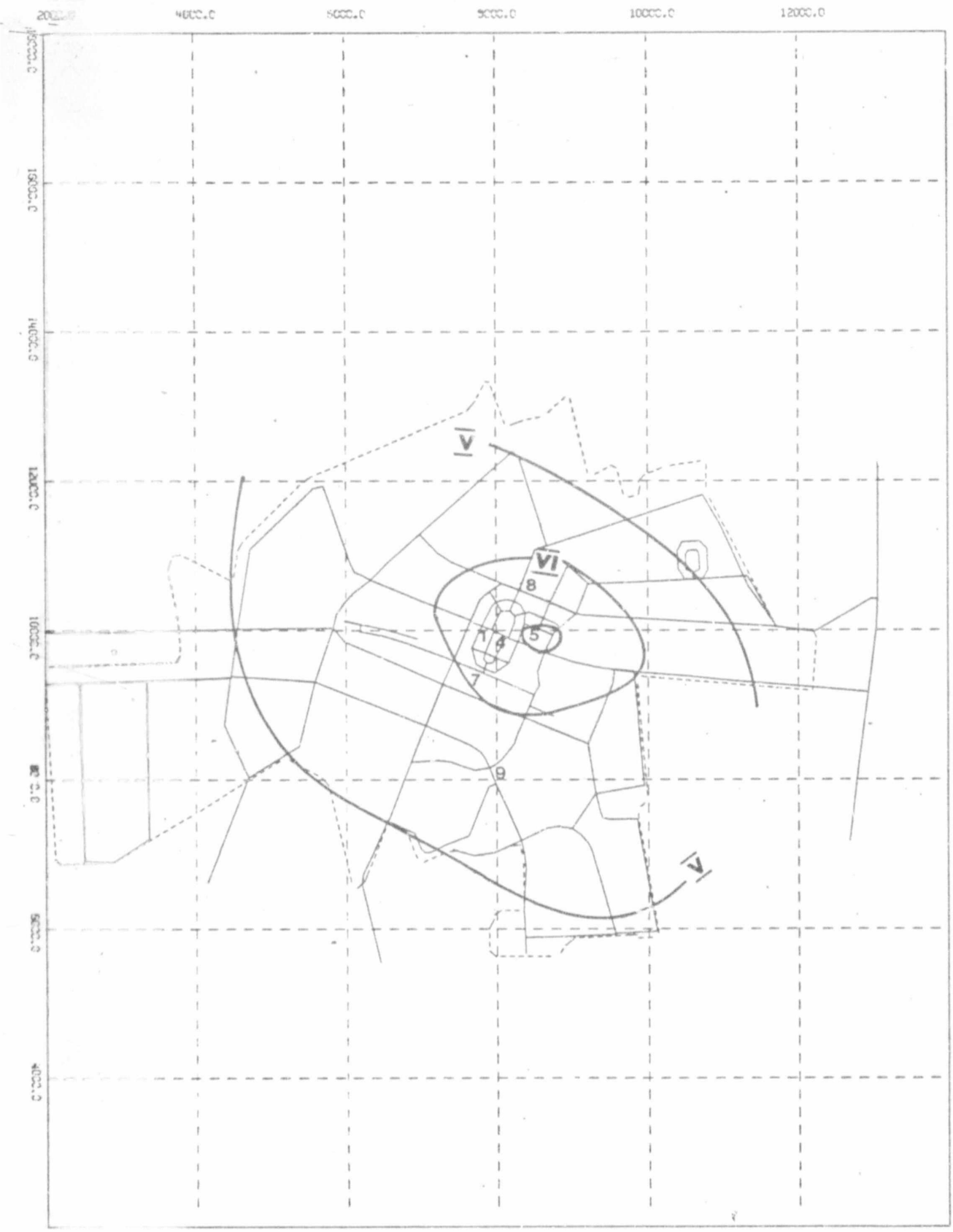


Figure A1-4

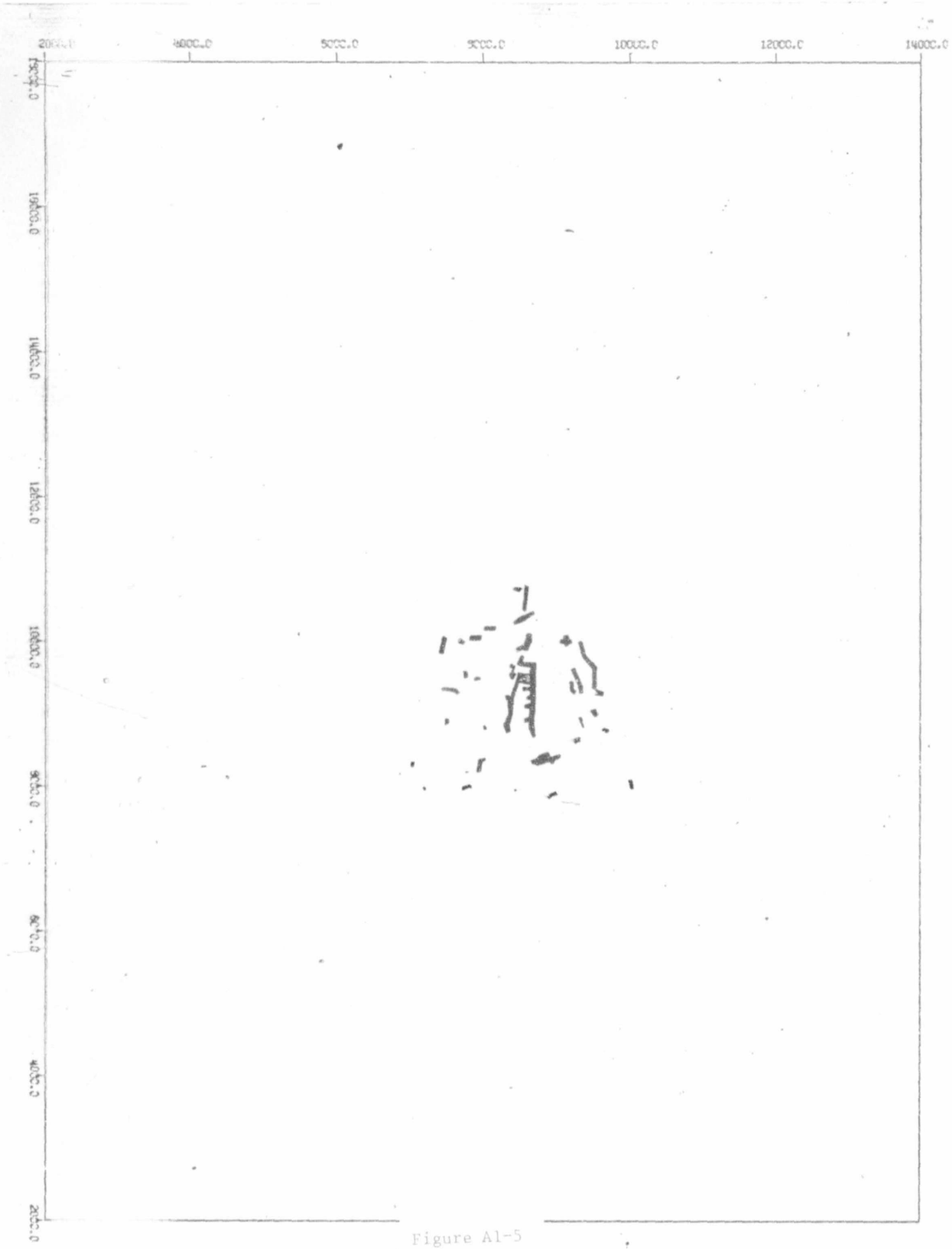

8000.0
5000.0
9000.0
10000.0
12000.0
14000.0
18000.0
16000.0
14000.0
12000.0
10000.0
8000.0
6000.0
4000.0
2000.0

Figure A1-5

A.E.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

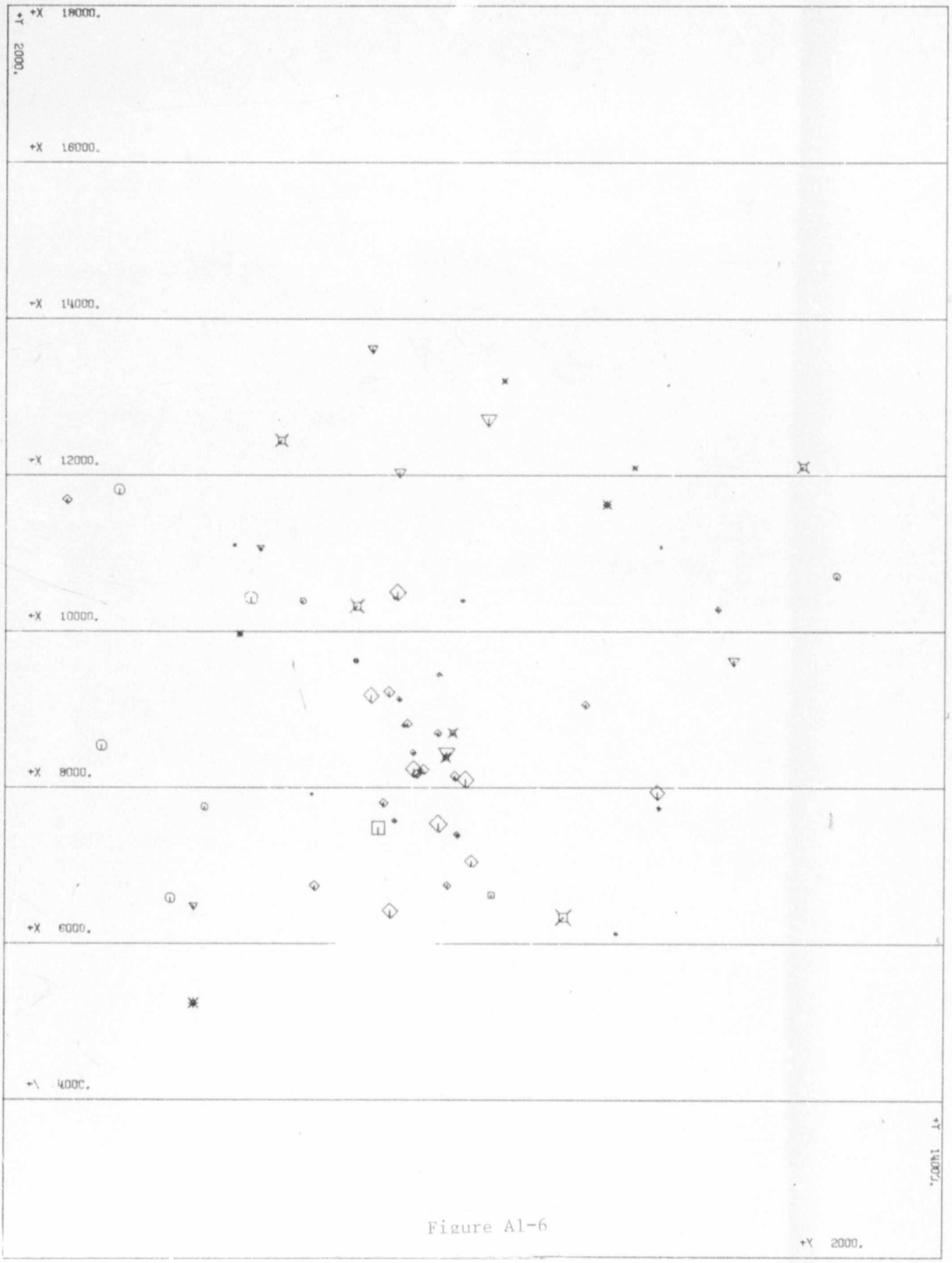


Figure A1-6

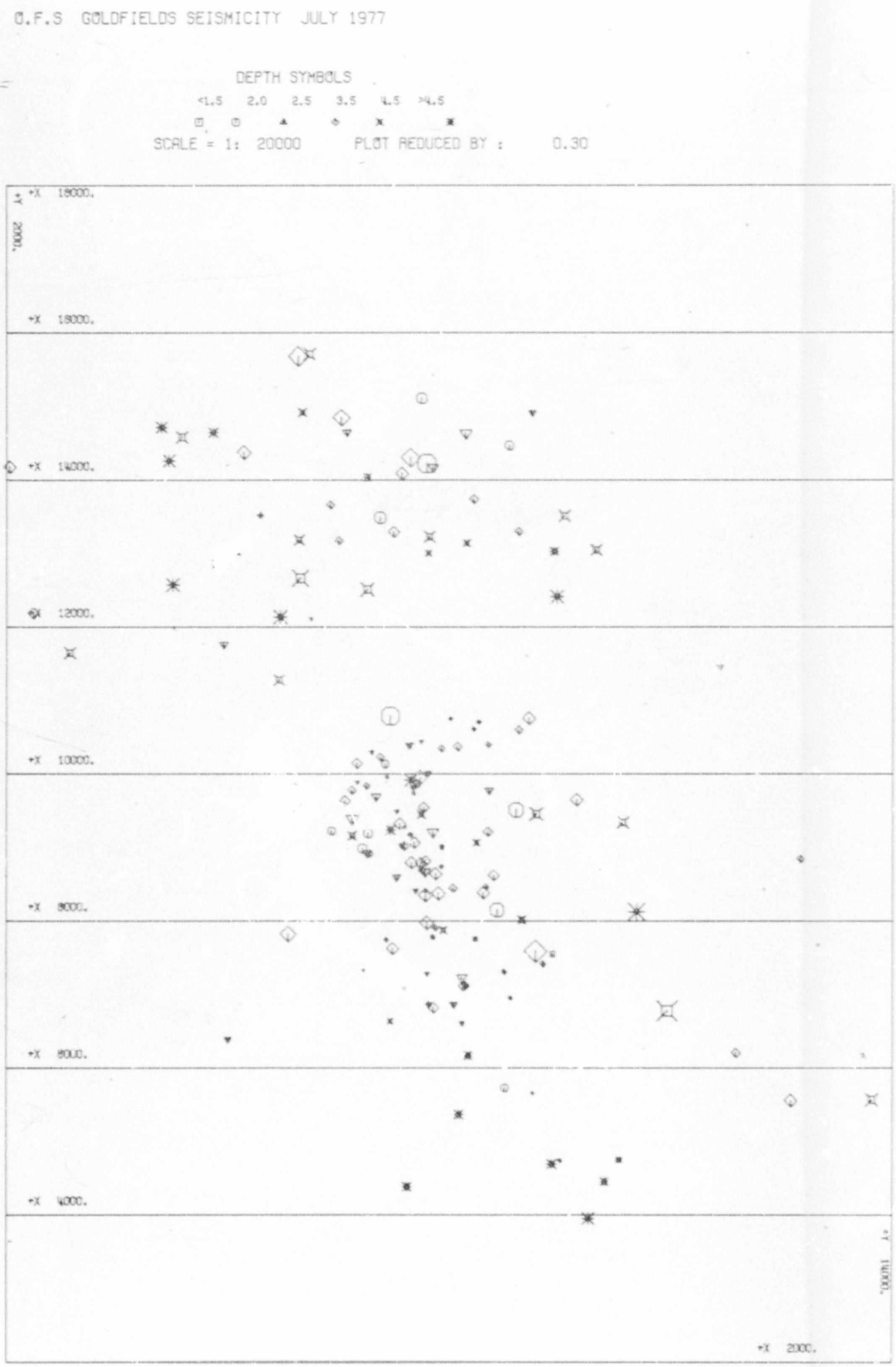

O.F.S GOLDFIELDS SEISMICITY JULY 1977
DEPTH SYMBOLS
<1.5 2.0 2.5 3.5 4.5 >4.5
SCALE = 1: 20000 PLOT REDUCED BY : 0.30
+Y 20000.
+X 18000.
+X 16000.
+X 14000.
+X 12000.
+X 10000.
+X 8000.
+X 6000.
+X 4000.
+Y 16000.
+X 2000.

Figure A1-7

Author Arnott Frank Walter
Name of thesis Seismicity In The Welkom Area, O.f.s. (with Special Reference To The Origin Of The 1976-12-8 Event). 1981

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