A COMPUTER PROGRAM FOR PROCESSING ELECTRON MICROPROBE DATA

by

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U. S. Geological Survey
OPEN FILE REPORT
This report is preliminary and has
not been edited or reviewed for
conformity with Geological Survey
standards and nomenclature.

Contents

INTRODUCTION

A computer program has been developed to eliminate the hand calculation necessary to reduce microprobe data from X-ray intensities to element or oxide weight percent. The need for such a program is obvious to anyone who has made a few data reductions using a hand calculator.

The program gives as much freedom to the microprobe operator as is commensurate with a short and simple run parameters sheet and total handling of the data by the computer. The input format is compatible with the print out modes available on the M.A.C. microprobe in service at the Menlo Park center of the U.S. Geological Survey, which utilizes 5 digits and exponential 10 multiplier print out, but it will also accept ARL modes which utilizes 6 digits print out of X-ray intensity data. The program can be used to best advantage in the analysis of multielement minerals using like mineral standards. In its present form it corrects raw X-ray intensities for dead-time, drift, background and corrects the elemental compositions for matrix absorption, but does not correct for fluorescence or atomic number effects.

The program described is written in Fortran IV; however, a listing of an earlier version of the program in ALGOL is available.[1/]

[1/] A listing of this version can be obtained from the author.

DEFINITION OF TERMS

For the purposes of this paper the following terms are defined:

Reading - the X-ray intensity value for one element that is obtained at a single point during one counting interval.

Data point - the X-ray intensity values for all elements obtained at a single point during one counting interval.

Data set - all readings that are to be averaged--in the course of computation--whether from one spot, one mineral grain, or one rock. All readings in one data set must have the same identification and code. Each data set will have a separate page printed out giving the average composition computed for the set.

Data group - all data sets within a standardization period (including the initial and final standardizations).

Run - refers collectively to all of the groups of data that are necessary before an absorption correction can be applied. This includes all major elements in the sample.

PHYSICAL CONSTANTS USED IN THE PROGRAM

In order for the run parameters sheet to be as short and as simple as possible, most of the physical constants required are imbedded in the program.

The atomic numbers and atomic weights used are those reported in the 1961 revision of the Commission of Atomic Weights and the International Union of Pure and Applied Chemistry (Cameron and Wichers, 1962).

Only one characteristic wavelength, the one most commonly used, for each element was imbedded in the program. The Kα series was chosen for elements from Na to Br, the Lα series for elements from Rb to Pb and the Mα series for Bi, Th, Pa, and U. If an absorption correction is desired it is therefore necessary to use one of these characteristic wavelengths. If no absorption correction is desired, no restriction of the wavelengths used need be made.

Mass absorption coefficients are calculated by the computer using the expression $\mu/\rho = C_i \lambda^{N_i}$ (Heinrich, 1966).

Where

μ/ρ = mass absorption coefficient

λ = the wavelength of the X-rays being absorbed

C_i = a constant that changes with atomic number of the absorber and region between absorption discontinuities

N_i = an exponent that changes with atomic number of the absorber and region between absorption discontinuities

The values of the constants are taken from Heinrich (1966) and are subject to the limitations and uncertainties that he discusses.

The critical excitation potential is calculated from the expression $E_c = 12.3977/\lambda_{abs}$, where λabs is the absorption edge. Values for λ_{abs} are also from Heinrich's tables (1966) and are imbedded in the program as part of the data necessary to determine μ/ρ.

As far as was practicable these physical constants were entered in the program as modules so that they may easily be updated when better values become available.

CORRECTION PROCEDURES

The correction procedures followed by the program are described in the order made.

Dead-time correction

Each reading in the sample and the standard(s) is corrected for dead-time independently (if desired). The dead-time correction is of the standard form:

$$N_o = N/(1-NT)$$

where N = observed counts per second

T = dead-time

N_o = counts per second corrected for dead-time

Since T varies with the type of detector as well as with the wavelength of the X-ray being detected, the decision was made to provide independent T's for each element (and thus for each detector-element combination). If no dead-time correction is desired, a zero must be placed in the appropriate position on the run parameters sheet.

Drift correction

Each reading is corrected for drift, assuming it to be linear between the initial and final standardizations. The correction is made separately for each channel because the detectors or amplifiers may drift independently. The assumption of linear drift over short intervals appears to be a good approximation, but time between standardizations of more than an hour should be avoided. Although any magnitude of drift correction can be made by the program, corrections of more than 2 or 3 percent per hour are suspect.

The time at which each integration is finished is recorded as hours, minutes and seconds from a digital clock. If no recording clock is available, and relative times are to be used, they should be entered as hours, minutes and seconds.

Background correction

Two methods of correcting the background are available. The first is designated as "predetermined background" and allows one to enter on the run parameters sheet the background (in counts per second) that is to be subtracted from the averaged readings of each set. This method is usually adequate when analyzing major elements in specimens having a mean atomic number near that of the standard.

The alternate method makes use of the proportionality of background with sample current (sample current is inversely proportional to $\bar{Z}$). To use this method two background readings must be taken either on specimens containing none of the elements being analyzed, or by moving the spectrometers off peak and taking the background readings on the standards or specimens used. It is suggested that $\bar{Z}$ of the sample be between the $\bar{Z}$'s of the two specimens on which the background readings are taken. This alternate method is to be preferred when analyzing minor elements, or when $\bar{Z}$ of the standard is much different than $\bar{Z}$ of the sample.

Absorption correction

The absorption correction is made using Philiberts (1963) formula for $f(\chi)$ as modified by Duncumb and Shields (1966).

$$f(\chi) = \frac{1 + h}{(1 + \chi/\sigma)\ [1 + h\ (1 + \chi/\sigma)]}$$

where $h = (1.2)\ (\bar{A}/\bar{Z}^2)$ [†]

$\chi = \mu/\rho\ \csc\psi\sin\varepsilon$ [*]

$\sigma = 4.5 \times 10^5/(E_o^{1.65} - E_c^{1.65})$ [‡]

[†] $\bar{A}$ is mean atomic number and $\bar{Z}$ is mean atomic weight.

[*] The term $\csc\psi\sin\varepsilon$ is designated on the transmittal sheet as probe const. ψ is X-ray take-off angle and ε is electron beam incidence angle.

[‡] E_o is the applied kilovoltage and E_c is the critical excitation potential. Constants are from Heinrich (1967).

APPROXIMATION OF OXYGEN IN THE SAMPLE

Since it is not possible to analyze for oxygen directly, it is necessary to estimate the amount of oxygen present in the sample. Two methods have been used in the past. The first assumes a valence for each element analyzed, converts the weight percent atom to weight percent oxide, and uses the difference as the amount of oxygen present. This method is not always exact, not only because the valence of each element is not always known, but because an element may be present in more than one valence state. An error is also introduced if the mineral is hydrous, since the oxygen in the water is not accounted for. The second method is to subtract the sum of the elements analyzed from 100 percent and use this value as the amount of oxygen present. If all the major cations have been determined, this provides a reasonable estimate.

The latter method has been chosen in this program. Although it is not ideal, it is no less ideal than the former, particularly if the sample is hydrated, or if it contains multivalent elements. An option has been provided to eliminate the oxygen estimate for sulfides and other samples containing no oxygen. The option is followed whenever no oxygen value is entered on the probe standards cards.

DATA CODING AND INPUT

Data from the microprobe is read into the computer from punched cards. Each card contains one line of output from the microprobe. The data on each card is as follows:

1. X-ray intensity readings from the three spectrometers.
2. Digital sample current.
3. Hours, minutes and seconds of the digital clock.
4. A nine digit code which identified the type of reading standard, sample, or background; provides sequential numbering of data sets so that equivalent data sets from separate data groups can be correlated; identifies spectrometers with the proper elements; identifies standard X-ray intensity readings with the proper composition and indicates how the first approximation of composition is to be made (by ratio or by calibration curve).

The input specifications are given in detail in Appendix A.

ACKNOWLEDGMENTS

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APPENDIX A

Input specifications for run parameters cards

Only one run parameters sheet per run is required for the program, a sample of which is included in the appendix. Data from the probe is used directly as it comes from the readout and only the addition of the code and alphanumeric identification of samples need be added. Thus it is possible to have the probe data punched on cards or tape and fed into the computer without any manual transferral of data.

Identification card

Columns	Description
1-80	Any alphanumeric information to identify the data. This information will appear as a heading on each page of output.

Options and operating conditions card

Columns	Description
7-10	Operating kilovoltage (F4.1).
22-27	Probe constant (cscψsine for M.A.C. probe) (F6.4).
40-42	Integration time (right justified) (I5).
53	Absorption correction "T" if wanted "F" if not wanted.

Columns (cont'd)	Description (cont'd)
55	Conversion of weight percent atom to weight percent oxide. "T" if wanted, "F" if not. The gravimetric factor is determined from the atomic weights imbedded in the program as required by the valences given on the valence card.
57	Predetermined background "T" if wanted "F" if not. If "F", the background card may be omitted, but two sets of background readings (with $\overline{Z}$ bracketing $\overline{Z}$ of the sample), and sample current values must be included in the data.
59	Rejection of readings that depart from the mean of the set by more than $2.5\sqrt{N}$. "T" if wanted "F" if not wanted.
61	Number of standards to be used to determine weight percent ("1" or "2"). "1" is used routinely. When "2" is used the two standards must have chemical compositions that bracket the chemical composition of the samples being analyzed. When either "1" or "2" is used all data in that run must be compatible with the selected mode.

Columns (cont'd)	Description (cont'd)
63-64	Number of standards used during an analysis. (I2) This number must equal the number of standards whose composition is entered on the run parameters sheet.

Dead-time cards

Columns	Description
1-8	"DEADTIME"
11	Number of elements to be determined
12-24	Exponential expression for T
	Dead-time for element 1 (E13.5)
26-38	Dead-time for element 2 (E13.5)
40-52	Dead-time for element 3 (E13.5)
54-66	Dead-time for element 4 (E13.5)
68-80	Dead-time for element 5 (E13.5)
12-24	Dead-time for element 6 (E13.5)
26-38	Dead-time for element 7 (E13.5)
40-52	Dead-time for element 8 (E13.5)
54-66	Dead-time for element 9 (E13.5)

If dead-time correction is wanted enter zeros in the appropriate columns.

Background card

The values for background must be given in counts per second. If column 35 of the options and operating conditions card is "F", the background card may be omitted.

Columns	Description
1-10	"BACKGRØUND"
12-13	Number of elements to be determined
15-20	Background for element 1 (F6.2)
22-27	Background for element 2 (F6.2)
29-34	Background for element 3 (F6.2)
36-41	Background for element 4 (F6.2)
43-48	Background for element 5 (F6.2)
50-55	Background for element 6 (F6.2)
57-62	Background for element 7 (F6.2)
64-69	Background for element 8 (F6.2)
71-76	Background for element 9 (F6.2)

Valence card

The elements being determined must be listed in the order given on the data sheets, even though conversion to oxide percent may not be wanted. The valence card provides the key to the elements being analyzed as well as wavelengths and absorption edges that are necessary to make the absorption correction.

Columns	Description
1-8	"VALENCES"
11	The number of elements being determined.
14-15	The atomic symbol for element 1 (left justified)
16-17	Valence of element 1
19-20	Same for element 2
21-22	
24-25	Same for element 3
26-27	
29-30	Same for element 4
31-32	
34-35	Same for element 5
36-37	
39-40	Same for element 6
41-42	
44-45	Same for element 7
46-47	
49-50	Same for element 8
51-52	
54-55	Same for element 9
56-57	

Composition of standards cards

All standards cards have same format. Elements entered for each standard must be listed in the same order even if it is necessary to enter some components as 0.00. Element symbols must always be included.

Columns	Description
1-4	"CØMP"
6-7	"PS"
8-9	An identification number for the standard. Used to key standards on the data sheets (col 50-51) to those on the transmittal sheet.
12-13	The number of elements in the standard (including those with weight percent atom entered as 0.00).
15-16	Atomic symbol for the first element in the standard (not necessarily the same as element 1 in the analysis).
17-22	Weight percent atom for element 1 in the standard (F5.2).
24-25	Same for element 2
26-31	
33-34	Same for element 3
35-40	
42-43	Same for element 4
44-49	

Columns (cont'd)	Description (cont'd)
51-52	Same for element 5
53-58	
60-61	Same for element 6
62-67	
69-70	Same for element 7
71-76	

For additional elements in the standard enter "CØMP PS" in appropriate columns of additional cards and proceed with same format as the first standards composition card.

Input specifications for X-ray intensity count data cards

Columns	Description
1-6	Digital X-ray intensity counts from spectrometer number 1
8	Exponential 10 multiplier for counts from spectrometer number 1
10-15	Digital X-ray intensity counts from spectrometer number 2
17	Exponential 10 multiplier for counts from channel number 2
19-24	Digital X-ray intensity counts from spectrometer number 3

Columns (cont'd)	Description (cont'd)
26	Exponential 10 multiplier for counts from channel number 3 EXAMPLE: If the value 13765 is in columns 19-24 and if 2 is in column 26, then the X-ray intensity count for channel number 3 is $13765X10^2$ or 1367500.
28-33	Digital specimen current
35	Negative exponential 10 multiplier for specimen current. EXAMPLE: If 000311 is in columns 28-33 and 3 is in column 35, then the specimen current is $311X10^{-3}$ or 0.311.
37-38	Hours of the digital clock
39-40	Minutes of the digital clock
41-42	Seconds of the digital clock REMARK: The time is read in and immediately converted to seconds, and set relative to the initial time of the data group.
44-52	These columns are codes to identify types of readings, elements being analyzed and composition of standards, as well as flags to delimit data sets and groups.

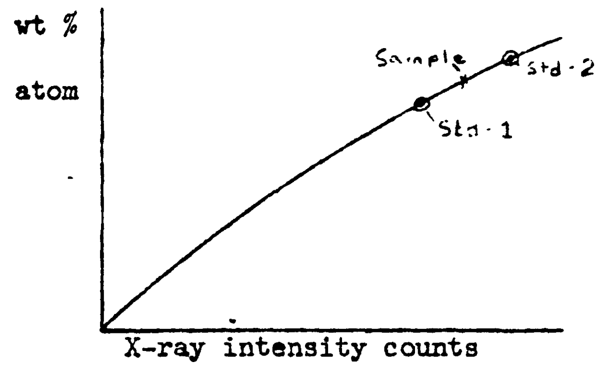
Columns (cont'd)	Description (cont'd)
44	Code 1. Indicates whether the set of data is a "probe standard", code 1 = 2; a "sample set", code 1 = 1; or a "background set", code 1 = 3. Code 1 = 0 (or a blank card) signals the end of a set of data, i.e. those data points that are to be averaged in the computation. Code 1 = 8 signals the end of a group of data sets (see annotated input sheets for an example). Code 1 = 9 signals the end of a run. After a "9" is entered for code 1, new run parameters cards are required before more data can be processed.
45-46	Code 2. A sequential number beginning at 1 indicates the relative sample, standard or background set number. (See annotated input sheets for an example.) EXAMPLE: If a set has code 1 = 1 and code 2 = 5, then that particular set is the fifth "sample" set of the group. Equivalent sample sets in separate groups must have the same code 2, and each group in a run must contain the same number of sample sets.

Columns (cont'd)	Description (cont'd)
47	Code 3 references spectrometer 1
48	Code 4 references spectrometer 2
49	Code 5 references spectrometer 3 REMARK: Codes 3, 4 and 5 have dual purposes. If any of them is left blank, or is zero, then the X-ray intensity counts in its relative channel are ignored. If there is a number between 1 and 9 in columns 47, 48 or 49, then the code associates its relative spectrometer with an element, having the same number, listed on the valence parameter card. EXAMPLE: If for a particular group code 5 = 3, then the third spectrometer of that group is associated with the fifth element on the valence parameter card.
50-51	Code 6 associates the probe standard data set with a particular probe standard composition card parameter card.

Columns (cont'd)	Description (cont'd)
50-51 (cont'd)	EXAMPLE: If a probe standard composition parameter card is numbered 15, and if a probe standard X-ray intensity count data set is to be associated with it, then code 6 must equal 15.
52	Code 7 identifies the first and second standards that define the calibration curve when column 61 on the options and operating conditions card is 2. EXAMPLE: If a first approximation of composition of a sample is to be made from a calibration curve defined by two standards, then code 7 must be set equal to 1 for the first standard data set, and to 2 for the second standard data set. To use this option column 61 of the options and operating conditions card must be set equal to 2. The following sketch shows how this option is used to advantage.

Columns (cont'd) | Description (cont'd)

52 (cont'd)



If the first approximation of composition of a sample is to be made using Castaing's method (1951), then code 7 must be set equal to 1. If code 7 is blank, then 1 is assumed by default.

REMARK: When code 7 of one probe standard is set to 1, and the other is set to 2, then both standards are used for calculating drift.

OUTPUT OF PROGRAM

The first page of output includes all of the information entered on the run parameters sheet as well as mass absorption coefficients calculated by the program for all elements listed in the standards. Succeeding pages have the identification of the run printed at the top of the page. The second page (and as many other pages as are necessary) lists the counts per second (corrected for dead-time and drift), time and sample current for each reading in the first group. The average counts per second of each set of data points is given, followed by the average corrected for background. This is followed by the standard deviation of the readings. If more than one group (i.e. more than three elements) is required to complete the analysis, the data for them are printed out in the same form as the first group.

The following information is printed out for each iteration of each set of data points (each set on separate pages).

Iteration no., Mean Atomic no., Mean Atomic weight, $H = 1.2\left[\frac{MAW}{(MAN)^2}\right]$, Element, Sigma, χ, $F(\chi)$, $\frac{PSF(\chi)}{F(\chi)}$, wt.%Atm., wt.%oxide and $\frac{\text{St.dev.}}{\text{Av.}}$. wt.%ox.

(1)

```
C   ----------------------------------------------------------------------
C   !               REVISED MICROPROBE DATA REDUCTION PROGRAM               !
C   !                              C922                                    !
C   !                                                                      !
C   !   THIS PROGRAM WAS ORIGINALLY WRITTEN BY JOHN TANIDA FOR             !
C   !   MEL BEESON.  THE REVISIONS WERE MADE BY PAT DOHERTY                !
C   !   ACCORDING TO INSTRUCTIONS GIVEN BY GERRY CZAMANSKE.                !
C   !   SUPPLEMENTARY ANNOTATION HAS BEEN ADDED, ALTHOUGH THE              !
C   !   MAINTENANCE PROGRAMMER DOES NOT CLAIM COMPLETE COMPREHENSION       !
C   !   OF THE ORIGINAL CODE.  COMPLETED ON FEBRUARY 15, 1971.             !
C   !                                                                      !
C   !   ANCIENT BUG IN DRIFT-CORRECTION ROUTINE REMOVED BY DOHERTY         !
C   !   ON MARCH 30, 1971.                                                 !
C   !                                                                      !
C   !   BACKGROUND OPTION CORRECTED BY DOHERTY ON OCTOBER 26, 1972         !
C   !                                                                      !
C   !   PROGRAM MODIFIED TO HANDLE 9 ELEMENTS IN ONE RUN BY GODSON         !
C   !   OCTOBER, 1973                                                      !
C   ----------------------------------------------------------------------
C   MICROPROBE PROGRAM OF BEESON - M0005 - MODULE LENGTH 168,888 BYTES
      DIMENSION SINT(4),PCNST(4),FMT(18),FMT1(18,4),D1(12),JNDX(12)
      COMMON /MACOAB/ ATW(105),MAC(105,105),SIG(20,9),WL(105),R(105,10),
     1 NI(105,2),CI(105,10),EO,EC(20),EOO(9)
      COMMON /MACO/PSAN(20),PSAS(20),NSTE
      COMMON /MAAB/KA(105),ANINDX(20),RSTAND(13),SAS(13),
     * SAN(10),VAL(10),PCST,SIDE,VIDE,ANIDE,AWK,BWK,CWK,SINTHE,OXIDE,
     * ATNCOR,RSSTND(13),SR(20,9),S(20,9)
      LOGICAL PREBG,CORRAB,OXIDE,REMOVE,TIMEB,BOO(50),DODT,DODR,ATNCOR
      INTEGER ANIDE,VIDE,AN,PSAN,SAN,PSI(12),PSCOL(12,12),INDX(12),
     1P1(12),P2(12),PS1(12),PS2(12),VAL,PSIDX(12),PSTN(20),EDT(10),
     2 ANINDX,SANI,SANJ
      REAL MAC,NI,NN,KEDGE,MACSUM,KA
      REAL*8 ID(5),SID(5,40),PSID(5,12)
      DIMENSION ALPH1(7),ALPH2(7),ALPH3(3),ALPH5(3),ALPH6(7),ALPH7(3),        0014
     1 TITLE(20),DS(12),PSTO(12),PSA1(12),SAV(12),STD(12),BGSL(12),
     * PDBG(13),ATM1(13),STDER1(13),DATA(50),SEC(50),CURR(50),NSE(40),
     * SDATA(30,12,40),ST(50,40),SSC(50,40),NPSE(12),PSDATA(30,12,12),
     4 PST(50,12),PSSC(50,12),PSAV(12,12),NBGE(2),BGDATA(20,12,2),
     5 BGSC(20,2),BGSCA(2),BGAV(12,2),PSATW(20,18),ATM(13,40),PSX(20),
     6 STDERR(13,40),BGT(20,2),MACSUM(20),PSFX(13),PSFL(13),NKEO(3),
     7 DT(13)
      LOGICAL * 1 IFM1(23)/'(','''','0','''',',','7','A','4','/','''',
     1 ' ','''',',',' ',' ','(','F','1','0','.','2',')',')'/
      LOGICAL * 1 IFM2(28)/'(',' ','2','X',',',' ',' ','(','4','X',
     1 ',','A','2',',','4','X',')',',','6','X',',','''','T','I','M',
     2 'E','''',')'/
      LOGICAL * 1 IFM3(21)/'(','''',' ','''',',',' ',' ','(','F','1',
     1 '0','.','2',')',',','4','X',',','I','6',')'/
      LOGICAL * 1 NOS(9)/'1','2','3','4','5','6','7','8','9'/
  601 FORMAT(1HO,121H*******************************************************   0021
     1**************************************************************          0022
     2****/1HO,20A4/1H ,14HIDENTIFICATION,2X,3A4,5A8/
     3 1HO,6X,'COUNTS PER SECOND CORRECTED FOR DEAD TIME,DRIFT AND',
     4 ' BACKGROUND')
      DATA FMT1/
     * '(3(F','6.0,','F2.0',',),8X',',F6.','0,F2','.0,3','F2.0',')    ',
     * '    ','    ','    ','    ','    ','    ','    ','    ','    ',
     *'(4(F','6.0,','2X),',',/9(F','6.0,','2X))',' ',' ',' ',
     * '    ','    ','    ','    ','    ','    ','    ','    ','    ',
     * '(3(F','6.0,','F1.0',',),T2','9,F3','.0,F','1.0,','T44,','3F2.',
     * '0,T3','6,I1',',T33',',I2,','2X,3','I1,I','2,I1',',T51',',A8)',
     * '(T43',',3(F','7.0,','F1.0',',),T3','5,F7','.0,F','1.0,','T20,',
     * '3F2.','0,T1','0,I1',',I2,','3I1,','I2,I','1,T1',',A8)','    '/
```

replacement pages for #23 thru 30 (19 pages)

```
      DATA PCNST/1.6071,1.2605,1.6071,1.2605/
      DATA SINT/0.55194,0.79335,0.55194,0.79335/
      DATA ALPH1/'AVER','AGE ','    ','    ','    ','    ','    '/,
     * DT/10*0.0/,
     1 ALPH2/'STAN','DARD',' DEV','IATI','ON  ','    ','    '/,
     2 ALPH7/'STAN','DARD',' '/,
     4 ALPH5/'SAMP','LE  ','    '/,ACOMP,ABACK,AVALE,ADEAD,OXYGEN/
     5 4HCOMP,4HBACK,4HVALE,4HDEAD,2HO /, AAA9,BLANK/'9   ','    '/
      DIMENSION STDEM(12),BETA2(7),HOMOX(12),BETAH(7)
      DATA BETA2/'STAN','DARD',' ERR','OR  ','    ','    ','    '/
      DATA BETAH/'HOMO','GENE','ITY ','INDE','X   ','    ','    '/
      NAMELIST/ACOEF/CI,NI,R,ATW,WL,KA
      SAS(13)=BLANK
      M=5
      NSEL=12
C...........READ ATOMIC COEFFICIENTS
      READ(M,ACOEF)
      AWK=-0.064
      BWK=0.034
      CWK=-1.03E-6
    1 READ(5,933,ERR=999,END=1000) TITLE
  933 FORMAT(20A4)
      DO 902 I=1,10
      PDBG(I)=0.0
  902 CONTINUE
      DO 2222 J=1,40
      DO 2222 I=1,10
      ATM(I,J)=0.0
 2222 STDERR(I,J)=0.0
      WRITE(6,904)
  904 FORMAT(1H1)
      WRITE(6,903) TITLE
  903 FORMAT(1H ,20A4)
C*****************READ IN PARAMETERS************************************
      READ(5,905,END=1000) EO,PCST,CT,NEPR,CORRAB,OXIDE,PREBG,REMOVE,
     1 NSTAND,NPST,DODR,DODT,ATNCOR,SINTHE
C 905 FORMAT(6X,F4.1,11X,F6.4,12X,F3.0,7X,I2,1X,4(L1,1X),I1,1X,I2,
  905 FORMAT(7X,F4.1,10X,F6.4,12X,F3.0,7X,I2,1X,4(L1,1X),I1,1X,I2,
     * 3(1X,L1),3X,F7.6)
      SIDE=BLANK
      VIDE=0
C...........SET DEFAULT VALUES OF PARAMETERS
      IF (NEPR .EQ. 0) NEPR=1
      IF (SINTHE .EQ. 0.0) SINTHE=SINT(NEPR)
      IF (PCST .EQ. 0.0) PCST=PCNST(NEPR)
C...........SET UP X-RAY DATA FORMAT
      DO 81 I=1,18
   81 FMT(I)=FMT1(I,NEPR)
      WRITE(6,906)     PCST,CT,CORRAB,OXIDE,PREBG,NSTAND,REMOVE,DODR,
     * DODT,ATNCOR,NEPR,SINTHE
  906 FORMAT(1H0,15HPROBE CONSTANT=,
     1 F8.4,4X,14HCOUNTING TIME=,F5.0/1H ,L1,22H ABSORPTION CORRECTION/
     2 1H ,L1,36H CONVERSION TO WEIGHT PER CENT OXIDE/1H ,L1,
     3 25H PREDETERMINED BACKGROUND/1H ,I1,25H NUMBER OF STANDARDS USED,
     4 39H FOR DETERMINING ATOMIC WEIGHT PER CENT/1H ,L1,
     5 60H REJECTION OF VALUES MORE THAN 2.5*SQRT(VALUE) FROM THE MEAN/
     6 ' ',L1,' DRIFT CORRECTION'/' ',L1,' DEADTIME'/
     * ' ',L1,' ATOMIC NUMBER CORRECTION'/' ',I1,' PROBE FORMAT'/
     7 ' ',F8.6,' SINE OF THE TAKE-OFF ANGLE OF THE PROBE')
      IF (CT .EQ. 0.0) GO TO 999
      RCT=1.0/CT
      IF (.NOT. DODT) GO TO 1008
C...........READ DEADTIME DATA IF REQUESTED
```

```
      READ(5,907,ERR=999,END=1000) CHK,NE,(DT(J),EDT(J),J=1,5)
  907 FORMAT(A4,5X,I2,5(F9.0,1X,I3),4X)
      IF (CHK .NE. ADEAD .OR. NE .GT. 9) GO TO 999
      IF (NE .LE. 5) GO TO 1009
      READ(5,908,ERR=999,END=1000) (DT(J),EDT(J),J=6,NE)
  908 FORMAT(11X,5(F9.0,1X,I3),4X)
 1009 DO 1010 J=1,NE
 1010 DT(J)=DT(J)*10.0**(EDT(J))
      WRITE(6,909) (DT(J),J=1,NE)
  909 FORMAT(1H0,8HDEADTIME/1H ,10(1PE12.5,1X))
 1008 IF (.NOT. PREBG) GO TO  23
C...........READ PREDETERMINED BACKGROUND DATA IF REQUESTED
      READ(5,910,ERR=999,END=1000) CHK,NE,(PDBG(J),J=1,NE)
  910 FORMAT(A4,7X,I2,9F7.2,4X)
      PDBG(10)=0.0
      WRITE(6,911) (PDBG(J),J=1,NE)
  911 FORMAT(1H0,24HPREDETERMINED BACKGROUND/1H ,18F7.2)
      IF (CHK .NE. ABACK .OR. NE .GT. 9) GO TO 999
C...........READ VALENCES (NOTE: NE=NUMBER OF ANALYSED ELEMENTS)
   23 READ(5,916,ERR=999,END=1000) CHK,NE,(SAS(J),VAL(J),J=1,NE)
  916 FORMAT(A4,5X,I2,1X,13(1X,A2,I2))
      WRITE(6,917) (SAS(J),VAL(J),J=1,NE)
  917 FORMAT(1H0,8HVALENCES/1H ,20(1X,A2,I2))
      IF (CHK .NE. AVALE .OR. NE .GT. 9) GO TO 999
      WRITE(6,912)
  912 FORMAT(1H0,20HSTANDARD COMPOSITION)
C...........READ STANDARD COMPOSITIONS (NOTE: NSTE=NUMBER OF STANDARD ELEMENTS)
      DO 24 K=1,NPST
      READ(5,913,ERR=999,END=1000) CHK,I,NSTE,(PSAS(J),PSATW(J,K),J=1,7)
  913 FORMAT(A4,3X,I2,2X,I2,1X,7(A2,F7.3),3X)
      IF (CHK .NE. ACOMP .OR. NSTE .GT. 14) GO TO 999
      IF (NSTE .LE. 7) GO TO 25
      READ(5,914,ERR=999,END=1000) (PSAS(J),PSATW(J,K),J=8,NSTE)
  914 FORMAT(13X,7(1X,A2,F6.2),4X)
   25 PSTN(K)=I
      I1=11
      IF (NSTE .LE. 11) I1=NSTE
      WRITE(6,915) I,(PSAS(J),PSATW(J,K),J=1,I1)
  915 FORMAT(1H ,4H PS ,I2,1X,11(1X,A2,F7.2 ))
      IF (NSTE .LE. 11) GO TO 24
      WRITE(6,918) (PSAS(J),PSATW(J,K),J=12,NSTE)
  918 FORMAT((' ',7X,11(1X,A2,F7.2)))
   24 CONTINUE
C*****************BOOKKEEPING AND DETERMINE ABSORPTION COEFFICIENT*****
      ANIDE=NATM(SIDE)
      IF (.NOT. OXIDE .OR. ANIDE .NE. 0) GO TO 26
      ANIDE=8
      VIDE=2
      SIDE=OXYGEN
   26 VIDE=IABS(VIDE)
      DO 27 J=1,NE
   27 SAN(J)=NATM(SAS(J))
      NE1=NE
      DO 28 J=1,NSTE
      PSAN(J)=NATM(PSAS(J))
      IF (PSAN(J) .EQ. 8) NE1=NE+1
   28 CONTINUE
      J=NE+1
      SAN(J)=8
      SAS(J)=OXYGEN
      DO 29 J=1,NE1
      SANJ=SAN(J)
      DO 30 I=1,NSTE
```

```
      I1=I
      IF (SANJ .EQ. PSAN(I)) GO TO 31
   30 CONTINUE
      WRITE(6,606) (PSAS(K),K=1,NSTE)
  606 FORMAT(1H0,45HSAMPLE ELEMENTS DO NOT CORRESPOND TO STANDARD,
     1 9H ELEMENTS/1H ,8HSTANDARD,20(1X,A2))
      WRITE(6,607) (SAS(K),K=1,NE)
  607 FORMAT(1H ,6HSAMPLE,20(1X,A2))
      GO TO 998
   31 IF (I1 .EQ. J) GO TO 29
      DO 32 K=1,NPST
      AW=PSATW(J,K)
      PSATW(J,K)=PSATW(I1,K)
   32 PSATW(I1,K)=AW
      AS=PSAS(J)
      PSAS(J)=PSAS(I1)
      PSAS(I1)=AS
      AN=PSAN(J)
      PSAN(J)=PSAN(I1)
      PSAN(I1)=AN
   29 CONTINUE
      DO 2001 I=1,NSTE
      SANI=PSAN(I)
      N=0
      DO 2002 J=1,NSTE
      IF (SANI .GE. PSAN(J)) N=N+1
 2002 CONTINUE
 2001 ANINDX(N)=I
C...........CLEAR ARRAYS
      DO 2006 I=1,20
      DO 2005 J=1,3
      SIG(I,J)=0.0
      SR(I,J)=0.0
      S(I,J)=0.0
 2005 CONTINUE
 2006 CONTINUE
      DO 2007 I=1,3
      NKEO(I)=0
 2007 CONTINUE
      NE1=NE
      JEO=0
C*****************READ IN X-RAY COUNTS**********************************
C...........CLEAR K2 INDEXES FOR STANDARD AND SAMPLE
 2000 K2ST=0
      K2SA=0
      JEO=JEO+1
C...........READ OPERATING VOLTAGE
      READ(5,3310,END=1000) EO
 3310 FORMAT (F4.1)
      WRITE(6,3311) EO
 3311 FORMAT(1H1,22HOPERATING KILOVOLTAGE=,F9.1)
      EOO(JEO)=EO
      IF (CORRAB) CALL ABSCO(&998,JEO)
C*****************ATOMIC NUMBER CORRECTION******************************
      DO 1052 I=1,NSTE
      SR(I,JEO)=0.0
 1052 S(I,JEO)=0.0
      IF (.NOT. ATNCOR) GO TO 1050
      REO=1.0/EO
      DO 1051 I=1,NSTE
      SANI=PSAN(I)
      IF (SANI .LT. 6 .OR. SANI .EQ. 10) GO TO 1051
      ECI=EC(I)
```

```
      Z=FLOAT(SANI)
      RJ=Z*(15.05*(1.0-EXP(-0.072*Z))+42.0/(Z**(0.1*Z))-Z*0.0025)
C...........STOPPING POWER
      S(I,JEO)=Z*ALOG(1166.0*(EO+ECI)*0.5/RJ)/ATW(SANI)
      W=ECI*REO
      W1=-0.581+W*(2.162+W*(-5.137+W*(9.213+W*(-8.619+W*2.962))))
      W2=-1.609+W*(-8.298+W*(28.791+W*(-47.744+W*(46.540-W*17.676))))
      W3=5.400+W*(19.184+W*(-75.733+W*(120.050+W*(-110.700+W*41.792))))
      W4=-5.725+W*(-21.645+W*(88.128+W*(-136.060+W*(117.750-W*42.445))))
      W5=2.095+W*(8.947+W*(-36.510+W*(55.694+W*(-46.079+W*15.851))))
      Z=Z*1.0E-2
C...........BACKSCATTER COEFFICIENT
      SR(I,JEO)=1.0+Z*(W1+Z*(W2+Z*(W3+Z*(W4+Z*W5))))
 1051 CONTINUE
 1050 CONTINUE
      NS=0
      NPS=0                                                            0131
      NBG=0                                                            0132
      TIMEB=.TRUE.                                                     0133
C...........READ TITLE CARD
   20 READ(5,3320,END=1000) K1,K2,(JNDX(I),I=1,12),K4,K45,K5,ID
 3320 FORMAT(I1,I2,12I1,I2,2I1,5A8)
      K89=K1
C...........TEST K1 FOR TERMINATOR FLAG
      IF(K1 .EQ. 8) GO TO 21
      IF(K1 .EQ. 9) GO TO 21
      IF(K1 .EQ. 0) GO TO 20
C...........READ NEW BACKGROUND DATA IF REQUESTED
      IF(K45 .NE. 1) GO TO 3360
      READ(5,910,ERR=999,END=1000) CHK,NE,(PDBG(J),J=1,NE)
      PDBG(10)=0.0
      WRITE(6,911) (PDBG(J), J=1,NE)
      IF(CHK .NE. ABACK .OR. NE .GT. 9) GO TO 999
 3360 CONTINUE
      IF(K1 .EQ. 1) GO TO 3335
      IF(K1 .EQ. 2) GO TO 3340
      WRITE(6,3325) K1,K2,(D1(I),I=1,12),K4,K45,K5,ID
 3325 FORMAT (1H0,'CODE-1 ERROR',1X,I1,I2,12I1,I2,2I1,5A8)
      GO TO 1000
C...........RESET K2 TO SEQUENTIAL VALUE
 3335 K2SA=K2SA+1
      K2=K2SA
C...........READ FIRST X-RAY COUNT CARD (SAMPLE DATA)
      READ(5,FMT,END=1000) (D1(I),I=1,3),TAU,(D1(I),I=4,12)
      IF (.NOT. TIMEB) GO TO 3370
      TAU1=TAU
      TIMEB=.FALSE.                                                    0139
 3370 CONTINUE
      M=0                                                              0141
      MSEL=0
      DO 3375 I=1,NSEL
      INDX(I)=13
      IF(JNDX(I).EQ.0) GO TO 3374
      MSEL=MSEL+1
      INDX(I)=JNDX(I)
 3374 CONTINUE
 3375 CONTINUE
      IF(MSEL.EQ.0) GO TO 9998
      DO 1024 I=1,5
 1024 SID(I,K2)=ID(I)
      IF (NS .LT. K2) NS=K2                                            0150
   12 M=M+1                                                            0152
      IF (M .GT. 50) GO TO 999
```

```
      DO 3378 I=1,NSEL
      SDATA(M,I,K2)=999999.
      IF(JNDX(I).EQ.0) GO TO 3377
      I1=JNDX(I)
      SDATA(M,I,K2)=D1(I)*RCT-PDBG(I1)
 3377 CONTINUE
 3378 CONTINUE
      ST(M,K2)=TAU-TAU1
C...........READ NEXT X-RAY COUNT CARD
      READ(5,FMT,END=1000) (D1(I),I=1,3),TAU,(D1(I),I=4,12)
C...........TEST FOR BLANK TERMINATOR CARD
      IF(TAU.NE.0) GO TO 12
      NSE(K2)=M
      GO TO 20
C...........RESET K2 TO SEQUENTIAL VALUE
 3340 K2ST=K2ST+1
      K2=K2ST
C...........READ FIRST X-RAY COUNT CARD (STANDARD DATA)
      READ(5,FMT,END=1000) (D1(I),I=1,3),TAU,(D1(I),I=4,12)
      IF (.NOT. TIMEB) GO TO 3380
      TAU1=TAU
      TIMEB=.FALSE.
 3380 CONTINUE
      DO 1025 I=1,5
 1025 PSID(I,K2)=ID(I)
      M=0
      DO 3382 I=1,NSEL
      PSCOL(I,K2)=JNDX(I)
 3382 CONTINUE
      IF (K5 .EQ. 0) K5=1
      PSI(K2)=K5
      PSIDX(K2)=K4
      IF (NPS .LT. K2) NPS=K2
   18 M=M+1
      IF (M .GT. 50) GO TO 999
      DO 3384 I=1,NSEL
      PSDATA(M,I,K2)=999999.
      IF(JNDX(I).EQ.0) GO TO 3383
      I1=JNDX(I)
      PSDATA(M,I,K2)=D1(I)*RCT-PDBG(I1)
 3383 CONTINUE
 3384 CONTINUE
      PST(M,K2)=TAU-TAU1
C...........READ NEXT X-RAY COUNT CARD
      READ(5,FMT,END=1000) (D1(I),I=1,3),TAU,(D1(I),I=4,12)
C...........TEST FOR BLANK TERMINATOR CARD
      IF(TAU.NE.0) GO TO 18
      NPSE(K2)=M
      GO TO 20
C*****************DETERMINE CURRENT AND COUNT DRIFT SLOPE**************
C...........AN "8" TERMINATOR CARD HAS BEEN READ
   21 TIMEB=.TRUE.
      IFM1(14)=NOS(1)
      IFM1(15)=NOS(2)
      IFM2(6)=NOS(1)
      IFM2(7)=NOS(2)
      IFM3(6)=NOS(1)
      IFM3(7)=NOS(2)
      IF (.NOT. DODR) GO TO 808
      PSTI=PST(1,1)
      I1=NPSE(1)
      I2=NPSE(NPS)
C...........SLOPE OF COUNT DRIFT (FOR EACH OF THE 3 ANALYSED ELEMENTS)
```

```
C...........CLEAR AVERAGES AND SLOPES
      DO 111 I=1,NSEL
      PSA1(I)=0.0
  111 DS(I)=0.0
C...........NUMBER OF STANDARDS PRECEEDING DATA
      TEMP=NPS
      TEMP=TEMP*0.5+0.4
      NE=TEMP
C...........EXAMINE PRECEEDING STANDARDS SEQUENTIALLY
      DO 8 K=1,NE
C...........TEST CODE 7 FOR 1 (OR BLANK)
      IF (PSI(K) .NE. 1) GO TO 8
      I1=NPSE(K)
      K1=K+1
C...........EXAMINE CONCLUDING STANDARDS SEQUENTIALLY
      DO 4 J=K1,NPS
C...........SEARCH FOR MATCHING STANDARD IDENTIFICATION
      IF (PSIDX(K) .NE. PSIDX(J)) GO TO 4
      I2=NPSE(J)
C...........TEST CODE 7 FOR 1 (OR BLANK)
      IF (PSI(J) .NE. 1) GO TO 4
      DO 5 I=1,NSEL
C...........TEST TO SEE IF THIS STANDARD APPLIES TO THIS ANALYSED ELEMENT
      IF (PSCOL(I,K) .LE. 0) GO TO 5
C...........PICK UP INITIAL STANDARD COUNT DATA
      DO 6 M=1,I1
    6 DATA(M)=PSDATA(M,I,K)
C...........SET STANDARD DATA AVERAGE (A ZERO PREVENTS DRIFT CORRECTION)
      PSA1(I)=AVE(DATA,I1)
C...........PICK UP FINAL STANDARD COUNT DATA
      DO 7 M=1,I2
    7 DATA(M)=PSDATA(M,I,J)
C...........PICK UP INITIAL TIME
      PSTO(I)=PST(1,K)
C...........CALCULATE DRIFT SLOPE (USING FINAL TIME AND FINAL AVERAGE)
      DS(I)=(AVE(DATA,I2)-PSA1(I))/(PST(I2,J)-PSTO(I))
    5 CONTINUE
    4 CONTINUE
    8 CONTINUE
  808 CONTINUE
C***********************************************************************
      DO 1026 J=1,NSEL
      P1(J)=0
 1026 P2(J)=0
      TEMP=NPS
      TEMP=TEMP*0.5+0.4
      NE=TEMP
      DO 15 K=1,NE
      IF(PSI(K) .EQ. 1) GO TO 16
      DO 17 J=1,NSEL
      IF (PSCOL(J,K) .NE. 0) P2(J)=K
   17 CONTINUE
      GO TO 15
   16 DO 1023 J=1,NSEL
      IF (PSCOL(J,K) .NE. 0) P1(J)=K
 1023 CONTINUE
   15 CONTINUE
C***********************************************************************
      DO 1030 J=1,NSEL
      PS1(J)=0
      PS2(J)=0
      IF (P1(J) .EQ. 0) GO TO 1030
      DO 1031 I=1,NPST
```

```
      I1=I                                                              0266
      IF (PSTN(I) .EQ. PSIDX(P1(J))) GO TO 1032                         0267
 1031 CONTINUE                                                          0268
      WRITE(6,608) (PSID(JJ,P1(J)),JJ=1,5)
  608 FORMAT(1H ,46HNO PROBE STANDARD PARAMETER CARD AVAILABLE FOR,     0270
     1 16H PROBE STANDARD ,5A8)
      GO TO 999                                                         0272
 1032 PS1(J)=I1                                                         0273
      IF (NSTAND .NE. 2) GO TO 1037                                     0274
      DO 1034 I=1,NPST                                                  0275
      I2=I                                                              0276
      IF (PSTN(I) .EQ. PSIDX(P2(J))) GO TO 1033                         0277
 1034 CONTINUE                                                          0278
      WRITE(6,608) (PSID(JJ,P2(J)),JJ=1,5)
      GO TO 999                                                         0280
 1033 PS2(J)=I2                                                         0281
 1037 IF (.NOT. CORRAB) GO TO 1030                                      0282
      PSMAN=0.0
      PSMAW=0.0                                                         0284
      RSUM=0.0
      DO 1035 K=1,NSTE                                                  0285
      M=PSAN(K)
      SUM=PSATW(K,I1)
      PSMAW=PSMAW+SUM
      ARATIO=SUM/ATW(M)
      RSUM=RSUM+ARATIO
      PSMAN=PSMAN+ARATIO*FLOAT(M)
      SUM=0.0                                                           0289
      IF (M .EQ. 8) GO TO 1035
      DO 1036 I=1,NSTE                                                  0290
 1036 SUM=SUM+MAC(PSAN(I),M)*PSATW(I,I1)
      PSX(K)=SUM*PCST*0.01                                              0292
 1035 MACSUM(K)=SUM
      PSMAW=PSMAW/RSUM
      PSMAN=PSMAN/RSUM
      PSH=1.2*PSMAW/(PSMAN*PSMAN)                                       0296
C...........FLORESCENCE CORRECTION
      M=INDX(J)
      SUM=1.0+PSX(M)/SIG(M,JEO)
      PSFX(M)=(1.0+PSH)/(SUM*(1.0+PSH*SUM))
      ASUM=0.0
      RRSTND=0.0
      SSSTND=0.0
      SANJ=PSAN(M)
      IF (SANJ .LT. 6 .OR. SANJ .EQ. 10) GO TO 1040
      IF (SANJ .GT. 11) CC=CI(SANJ,1)/CI(SANJ,2)
      NN=NI(SANJ,1)-NI(SANJ,2)
      KEDGE=R(SANJ,1)
      ATWJ=ATW(SANJ)
      SMMAC=MACSUM(M)
      ECM=EC(M)
      UA=EO/ECM
      UA=UA*ALOG(UA)-UA+1.0
      DO 1041 I=1,NSTE
      K=ANINDX(I)
      ATWK=PSATW(K,I1)
      IF (ATWK .EQ. 0.0) GO TO 1041
      SANI=PSAN(K)
      IF (SANI .LT. 6 .OR. SANI .EQ. 10) GO TO 1041
      SKMAC=MACSUM(K)
      IF (SANI .EQ. SANJ .OR. KA(SANI) .GE. KEDGE .OR. SKMAC .EQ. 0.0
     * .OR. SANI .LT. 12 .OR. SANJ .LT. 12 .OR. SANI .GT. 39 .OR.
     * SANJ .GT. 39) GO TO 1042
```

```
      ECK=EC(K)
      WK=(AWK+SANI*(BWK+CWK*SANI*SANI))**4
      WK=WK/(1.0+WK)*0.5
      RR=CC*WL(SANI)**NN
      RR=(RR-1.0)/RR
      UB=EO/ECK
      UB=UB*ALOG(UB)-UB+1.0
      V=SIG(K,JEO)/SKMAC
      V=ALOG(1.0+V)/V
      U=SMMAC/(SKMAC*SINTHE)
      U=ALOG(1.0+U)/U
      ASUM=ASUM+WK*ATWK*RR*ATWJ/ATW(SANI)*(ECK)**0.3
     * *MAC(SANI,SANJ)/SKMAC*UB/UA*(U+V)
 1042 RRSTND=RRSTND+SR(K,JEO)*ATWK
      SSSTND=SSSTND+S(K,JEO)*ATWK
 1041 CONTINUE
 1040 RSTAND(M)=PSFX(M)*(1.0+ASUM)
      PSFL(M)=ASUM
      RSSTND(M)=RRSTND/SSSTND
 1030 CONTINUE
      WRITE(6,904)
C*****************REFINE PROBE STANDARD COUNTS*************************
   60 DO 61 K=1,NPS
      WRITE(6,601) TITLE,ALPH7,(PSID(JJ,K),JJ=1,5)
      NE=NPSE(K)
      DO 62 M=1,NE
   62 SEC(M)=PST(M,K)
      DO 63 J=1,NSEL
      PSAV(J,K)=0.0
      STD(J)=0.0
      STDEM(J)=0.0
      IF(PSDATA(1,J,K).GE.999998.) GO TO 63
      DO 64 M=1,NE
      BOO(M)=.TRUE.
   64 DATA(M)=PSDATA(M,J,K)
      IF (DODT .AND. DT(INDX(J)) .NE. 0.0)
     * CALL DEADT(DATA,NE,DT(INDX(J)))
C...........APPLY DRIFT CORRECTION TO STANDARD COUNT DATA
      IF (DODR .AND. PSA1(J) .NE. 0.0)
     * CALL DRCORR(DATA,SEC,NE,PSA1(J),PSTO(J),DS(J))
      IF (.NOT. REMOVE) GO TO 66
      AV=AVE(DATA,NE)
      DO 65 M=1,NE
      IF (ABS(DATA(M)-AV) .GT. 2.5*SQRT(DATA(M))) BOO(M)=.FALSE.
   65 CONTINUE
   66 CALL AVESTD(DATA,BOO,NE,PSAV(J,K),STD(J),STDEM(J))
      DO 67 M=1,NE
   67 PSDATA(M,J,K)=DATA(M)
   63 CONTINUE
      WRITE(6,IFM2)(SAS(INDX(J)),J=1,NSEL)
      DO 68 M=1,NE
      ISEC=IFIX(SEC(M))
   68 WRITE(6,IFM3)(PSDATA(M,J,K),J=1,NSEL),ISEC
      WRITE(6,IFM1)ALPH1,(PSAV(J,K),J=1,NSEL)
      WRITE(6,IFM1)ALPH2,(STD(J),J=1,NSEL)
      WRITE(6,IFM1)BETA2,(STDEM(J),J=1,NSEL)
      DO 4410 J=1,NSEL
 4410 HOMOX(J)=STD(J)/(SQRT(ABS(PSAV(J,K)))+1.0E-10)
      WRITE(6,IFM1)BETAH,(HOMOX(J),J=1,NSEL)
   61 CONTINUE
C*****************REFINE SAMPLE COUNTS*********************************
      DO 71 K=1,NS
      WRITE(6,601) TITLE,ALPH5,(SID(JJ,K),JJ=1,5)
```

```
      NE=NSE(K)
      DO 72 M=1,NE
   72 SEC(M)=ST(M,K)
      DO 73 J=1,NSEL
      SAV(J)=0.0
      STD(J)=0.0
      STDEM(J)=0.0
      IF(SDATA(1,J,K).GE.999998.) GO TO 73
      DO 74 M=1,NE
      BOO(M)=.TRUE.
   74 DATA(M)=SDATA(M,J,K)
      IF (DODT .AND. DT(INDX(J)) .NE. 0.0)
     * CALL DEADT(DATA,NE,DT(INDX(J)))
C...........APPLY DRIFT CORRECTION TO SAMPLE COUNT DATA
      IF (DODR .AND. PSA1(J) .NE. 0.0)
     * CALL DRCORR(DATA,SEC,NE,PSA1(J),PSTO(J),DS(J))
      IF (.NOT. REMOVE) GO TO 76
      AV=AVE(DATA,NE)
      DO 75 M=1,NE
      IF (ABS(DATA(M)-AV) .GT. 2.5*SQRT(DATA(M))) BOO(M)=.FALSE.
   75 CONTINUE
   76 CALL AVESTD(DATA,BOO,NE,SAV(J),STD(J),STDEM(J))
      IF (SAV(J) .NE. 0.0) STDERR(INDX(J),K)=STD(J)/SAV(J)
      DO 77 M=1,NE
   77 SDATA(M,J,K)=DATA(M)
   73 CONTINUE
      WRITE(6,IFM2)(SAS(INDX(J)),J=1,NSEL)
      DO 78 M=1,NE
      ISEC=IFIX(SEC(M))
   78 WRITE(6,IFM3)(SDATA(M,J,K),J=1,NSEL),ISEC
      WRITE(6,IFM1)ALPH1,(SAV(J),J=1,NSEL)
      WRITE(6,IFM1)ALPH2,(STD(J),J=1,NSEL)
      WRITE(6,IFM1)BETA2,(STDEM(J),J=1,NSEL)
      DO 4420 J=1,NSEL
 4420 HOMOX(J)=STD(J)/(SQRT(ABS(SAV(J)))+1.0E-10)
      WRITE(6,IFM1)BETAH,(HOMOX(J),J=1,NSEL)
      IF (NSTAND .NE. 2) GO TO 783
      DO 784 J=1,NSEL
      IF(INDX(J).EQ.13) GO TO 784
      IF (P2(J) .EQ. 0 .OR. P1(J) .EQ. 0 .OR. PS2(J) .EQ. 0 .OR. PS1(J)
     1 .EQ. 0) GO TO 995
      SUM=PSAV(J,P2(J))-PSAV(J,P1(J))
      IF (SUM .EQ. 0.0) GO TO 784
      PSSL=(PSATW(INDX(J),PS2(J))-PSATW(INDX(J),PS1(J)))/SUM
      ATM(INDX(J),K)=PSSL*(SAV(J)-PSAV(J,P1(J)))+PSATW(INDX(J),PS1(J))
  784 CONTINUE
      GO TO 71
  783 DO 785 J=1,NSEL
      IF(INDX(J).EQ.13) GO TO 785
      ATM(INDX(J),K)=0.0
      IF ( P1(J) .EQ. 0 .OR. PS1(J) .EQ. 0 .OR. P1(J) .GT. 12 .OR.
     1 PS1(J) .GT. 18) GO TO 995
      IF (PSAV(J,P1(J)) .NE. 0.0) ATM(INDX(J),K)=PSATW(INDX(J),PS1(J))*
     1 SAV(J)/PSAV(J,P1(J))
  785 CONTINUE
   71 CONTINUE
      NSS=NS
      IF(JEO.EQ.1) GO TO 4460
      NKEO(JEO)=MSEL+NKEO(JEO-1)
      GO TO 4470
 4460 NKEO(JEO)=MSEL
 4470 IF(K89 .EQ. 8) GO TO 2000
C*****************APPLY ABSORPTION CORRECTION AND PRINT OUTPUT*********
```

```
C...........A "9" TERMINATOR CARD HAS BEEN READ
   22 DO 40 K=1,NSS
      WRITE(6,609) TITLE,ALPH5,(SID(JJ,K),JJ=1,5)
  609 FORMAT(1H1,121H****************************************************
     1*************************************************************
     2****/1H0,20A4/1H ,14HIDENTIFICATION,2X,3A4,5A8)
      DO 41 J=1,NE1
      ATM1(J)=ATM(J,K)
   41 STDER1(J)=STDERR(J,K)
      IF (CORRAB) GO TO 44
      CALL NOACOR(ATM1,STDER1,NE1)
      GO TO 40
   44 WRITE(6,610)
  610 FORMAT ('0','ELEMENT',4X,'SIGMA',4X,'SIGMA',4X,'SIGMA',7X,
     *  'PSF(X)',5X,'PSFL',5X,'R/S STND')
      DO 43 I=1,NE1
   43 WRITE(6,611) PSAS(I),SIG(I,1),SIG(I,2),SIG(I,3),PSFX(I),PSFL(I),
     *  RSSTND(I)
  611 FORMAT (' ',2X,A2,5X,3F9.2,5F11.6)
      CALL ABCORR(ATM1,STDER1,NE1,NKEO)
   40 CONTINUE
      GO TO 1
C*****************FLUSH DATA CARDS*************************************
  995 DO 996 J=1,NSEL
  996 WRITE(6,1001) P2(J),P1(J),PS1(J),PS2(J)
 1001 FORMAT(1H0,9I3)
  999 WRITE(6,605) ID
  605 FORMAT(1H0,41HRUN FLUSHED DUE TO ERROR IN DATA CARDS...,A8)
  998 READ(5,997,END=1000) AA1
  997 FORMAT(A4)
      IF(AA1 .EQ. AAA9) GO TO 1
      GO TO 998
 9998 WRITE(6,4440)
 4440 FORMAT('0','NUMBER OF SAMPLE ELEMENTS IS ZERO')
 1000 WRITE(6,904)
      STOP
      END
C*****************CONVERT ATOMIC SYMBOL INTO ATOMIC NUMBER************
      INTEGER FUNCTION NATM(ATS)
      INTEGER ATN
      DIMENSION SYM(119),ATN(14)
      DATA SYM/'H ','HE','LI','BE','B ','C ','N ','O ','F ','NE','NA',
     1 'MG','AL','SI','P ','S ','CL','AR','K ','CA','SC','TI','V ','CR',
     2 'MN','FE','CO','NI','CU','ZN','GA','GE','AS','SE','BR','KR','RB',
     3 'SR','Y ','ZR','NB','MO','TC','RU','RH','PD','AG','CD','IN','SN',
     4 'SB','TE','I ','XE','CS','BA','LA','CE','PR','ND','PM','SM','EU',
     5 'GD','TB','DY','HO','ER','TM','YB','LU','HF','TA','W ','RE','OS',
     6 'IR','PT','AU','HG','TL','PB','BI','PO','AT','RN','FR','RA','AC',
     7 'TH','PA','U ','NP','PU','AM','CM','BK','CF','ES','FM','MD','NO',
     8 'XX','XX','  ',' H',' B',' C',' N',' O',' F',' P',' S',' K',' V',
     9 ' Y',' I',' W',' U'/,ATN/1,5,6,7,8,9,15,16,19,23,39,53,74,92/
      IF (ATS .EQ. SYM(105)) GO TO 5
      DO 1 I=1,105
      K=I
      IF (ATS .EQ. SYM(I)) GO TO 2
    1 CONTINUE
      K=0
      DO 3 I=106,119
      K=K+1
      IF (ATS .EQ. SYM(I)) GO TO 4
    3 CONTINUE
    5 NATM=0
      RETURN
```

```
    4 NATM=ATN(K)
      RETURN
    2 NATM=K
      RETURN
      END
C******************ABSORPTION COEFFICIENTS******************************
      SUBROUTINE ABSCO(*,JEO)
      COMMON /MACOAB/ ATW(105),MAC(105,105),SIG(20,9),WL(105),R(105,10),
     1 NI(105,2),CI(105,10),EO,EC(20),EDO(9)
      COMMON /MACD/PSAN(20),PSAS(20),NSTE
      REAL NI,MAC,N
      INTEGER PSAN,A,ANS,ANI,S,P,AB
      DIMENSION E(12),C(11),N(11)
      N(5)=2.6
      N(6)=2.6
      N(7)=2.6
      N(8)=2.6
      N(9)=0.0
      N(10)=2.22
      E(1)=0.7
      DO 1 I=1,NSTE
      ANI=PSAN(I)
      N(1)=NI(ANI,1)
      N(2)=NI(ANI,2)
      N(3)=N(2)
      N(4)=N(2)
      DO 2 L=1,10
      C(L)=CI(ANI,L)
      A=L+1
      E(A)=R(ANI,L)
    2 CONTINUE
      DO 1 S=1,NSTE
      ANS=PSAN(S)
      MAC(ANI,ANS)=0.0
      IF (ANS .EQ. 8) GO TO 1
      DO 3 J=1,10
      A=J+1
      IF (E(J) .LE. WL(ANS) .AND. WL(ANS) .LE. E(A)) GO TO 4
    3 CONTINUE
      GO TO 1
    4 IF (A .EQ. 10) GO TO 1
      A=A-1
      IF (C(A) .EQ. 0.0 .OR. WL(ANS) .EQ. 0.0) GO TO 1
      MAC(ANI,ANS)=C(A)*WL(ANS)**N(A)
    1 CONTINUE
      WRITE(6,91)
   91 FORMAT('0','MASS ABSORPTION COEFFICIENTS'/' ',35X,'EMITTERS')
      NE1=NSTE
      IF (PSAN(NSTE) .EQ. 8) NE1=NE1-1
      S=NE1/9
      IF (S .EQ. 0) GO TO 14
      DO 5 P=1,S
      A=P*9
      AB=A-8
      WRITE(6,92) (PSAS(I),I=AB,A)
   92 FORMAT('0','ABSORBER',6X,A2,8(9X,A2))
      DO 6 L=1,NSTE
    6 WRITE(6,93) PSAS(L),(MAC(PSAN(L),PSAN(I)),I=AB,A)
   93 FORMAT(' ',3X,A2,4X,9F11.4)
    5 CONTINUE
   14 S=MOD(NE1,9)
      IF (S .EQ. 0) GO TO 7
      A=NE1-S+1
```

```
      WRITE(6,92) (PSAS(I),I=A,NE1)
      DO 8 L=1,NSTE
    8 WRITE(6,93) PSAS(L),(MAC(PSAN(L),PSAN(I)),I=A,NE1)
    7 DO 9 I=1,NSTE
      ANS=PSAN(I)
      SIG(I,JEO)=0.0
      EC(I)=0.0
      IF (ANS .LT. 6 .OR. ANS .EQ. 10) GO TO 13
      IF (ANS .GT. 35) GO TO 10
      A=1
      GO TO 11
   10 IF (ANS .GT. 82) GO TO 12
      A=2
      GO TO 11
   12 IF (ANS .GT. 92) GO TO 13
      A=5
      GO TO 11
   13 WRITE(6,94) ANS
   94 FORMAT(' ','NO ABSORPTION COEFFICIENT DATA AVAILABLE FOR ELEMENT',
     1 1X,I2)
      RETURN 1
   11 EDGE=R(ANS,A)
      IF (EDGE .EQ. 0.0) GO TO 9
      EC(I)=12.39770/EDGE
      SIG(I,JEO)=4.5E5/(EO**1.65-EC(I)**1.65)
    9 CONTINUE
      RETURN
      END
C*****************PRINT FIRST APPROXIMATION***************************
      SUBROUTINE NOACOR(ATM,STDERR,NE)
      DIMENSION ATM(10),STDERR(10)
      COMMON /MACOAB/ ATW(105),MAC(105,105),SIG(20,9),WL(105),R(105,10),
     1 NI(105,2),CI(105,10),EO,EC(20),EOO(9)
      COMMON /MAAB/KA(105),ANINDX(20),RSTAND(13),SAS(13),
     * SAN(10),VAL(10),PCST,SIDE,VIDE,ANIDE,AWK,BWK,CWK,SINTHE,OXIDE,
     * ATNCOR,RSSTND(13),SR(20,9),S(20,9)
C    * ATNCOR,RSTND(10),SSTND(10)
      INTEGER SAN,VIDE,ANIDE,VAL,ANINDX
      REAL MAC,NI,KA
      LOGICAL OXIDE
      WRITE(6,93) SIDE,SIDE
   93 FORMAT('0','ELEMENT',5X,'WT % ATOM',4X,'WT(',A2,')',5X,
     1 '(ST DEV/AVE)*',A2)
      ASUM=0.0
      OSUM=0.0
      DO 1 J=1,NE
      ASUM=ASUM+ATM(J)
      OX=0.0
      IF (.NOT. OXIDE) GO TO 3
      OX   =ATM(J)*(VIDE*ATW(SAN(J))+VAL(J)*ATW(ANIDE))/(VIDE*ATW(SAN(J)
     1 ))
      OSUM=OSUM+OX
      OXER=OX*STDERR(J)
      GO TO 2
    3 OXER=ATM(J)*STDERR(J)
    2 WRITE(6,92) SAS(J),ATM(J),OX,OXER
   92 FORMAT(' ',2X,A2,8X,F9.4,3X,F10.4,5X,F9.6)
    1 CONTINUE
      WRITE(6,94) ASUM,OSUM
   94 FORMAT(' ',12X,F9.4,3X,F10.4)
      RETURN
      END
C*****************AVERAGE AND STANDARD DEVIATION**********************
```

```
      SUBROUTINE AVESTD (X,B,N,A,S,E)
      LOGICAL B
      DIMENSION X(N),B(N)
      S=0.0
      E=0.0
      A=0.0
      SM=0.0
      DO 1 I=1,N
      IF (.NOT. B(I)) GO TO 1
      A=A+X(I)
      SM=SM+1.0
    1 CONTINUE
      IF (SM .LT. 1.0) RETURN
      A=A/SM
      IF (SM .LT. 2.0) RETURN
      DO 2 I=1,N
      IF (.NOT. B(I)) GO TO 2
      S=S+(X(I)-A)**2
    2 CONTINUE
      S=SQRT(S/(SM-1.0))
      E=S/SQRT(SM)
      RETURN
      END
C******************CORRECT FOR DEADTIME************************************
      SUBROUTINE DEADT(X,N,DT)
      DIMENSION X(N)
      DO 1 I=1,N
    1 X(I)=X(I)/(1.0-DT*X(I))
      RETURN
      END
C******************AVERAGE**************************************************
      REAL FUNCTION AVE(X,N)
      DIMENSION X(N)
      SN=N
      SUM=0.0
      DO 1 I=1,N
    1 SUM=SUM+X(I)
      AVE=SUM/SN
      RETURN
      END
C******************CORRECT FOR DRIFT***************************************
      SUBROUTINE DRCORR(X,T,N,AVER,TO,SLOPE)
      DIMENSION X(N),T(N)
      DO 1 I=1,N
    1 X(I)=X(I)*AVER/(SLOPE*(T(I)-TO)+AVER)
      RETURN
      END
C******************CORRECT FOR ABSORPTIONS************************M*M**
      SUBROUTINE ABCORR(ATM,STDERR,NE,NKEO)
      COMMON /MACOAB/ ATW(105),MAC(105,105),SIG(20,9),WL(105),R(105,10),
     1 NI(105,2),CI(105,10),EO,EC(20),EOO(9)
      COMMON /MAAB/KA(105),ANINDX(20),RSTAND(13),SAS(13),
     * SAN(10),VAL(10),PCST,SIDE,VIDE,ANIDE,AWK,BWK,CWK,SINTHE,OXIDE,
     * ATNCOR,RSSTND(13),SR(20,9),S(20,9)
      REAL MAN,MAW,MAC,NN,KEDGE,MACSUM,KF,KA,NI
      INTEGER VAL,SAN,VIDE,ANIDE,SANJ,ANINDX,SANI,PSAN
      LOGICAL OXIDE,ATNCOR
      DIMENSION ATMC(10),ATM1(10),FX(10),OX(10),OXER(10),RATIO(10),
     1 ATM(10),STDERR(10),X(10),MACSUM(10),KF(10),RSAMP(10),ANC(10)
      DIMENSION RSSAMP(9),NKEO(3)
      NE1=NE+1
      NNE=NE
      IF (OXIDE) NNE=NE1
```

```
      DO 2001 I=1,NE
      SANI=SAN(I)
      N=0
      DO 2002 J=1,NE
      IF (SANI .GE. SAN(J)) N=N+1
 2002 CONTINUE
 2001 ANINDX(N)=I
      SAN(NE1)=ANIDE                                                    0650
      OX(NE1)=0.0                                                       0651
      DO 1 J=1,NE                                                       0652
      OX(J)=0.0                                                         0653
      ATMC(J)=ATM(J)                                                    0654
    1 ATM1(J)=ATM(J)                                                    0655
      DO 10 I=1,3
      RSSAMP(I)=0.0
   10 CONTINUE
      DO 2 N=1,20                                                       0656
      MAN=0.0
      MAW=0.0                                                           0659
      SUM=0.0                                                           0657
      RSUM=0.0
      DO 30 J=1,NE
      ASUM=ATM1(J)
      SUM=SUM+ASUM
      ATM(J)=ASUM
      ARATIO=ASUM/ATW(SAN(J))
      RSUM=RSUM+ARATIO
      MAN=MAN+ARATIO*SAN(J)
      MAW=MAW+ASUM
   30 CONTINUE
      ASUM=100.0-SUM
      ATM(NE1)=ASUM
      FNORM=1.0
      IF (.NOT. OXIDE) FNORM=100.0/SUM
      IF (.NOT. ATNCOR) GO TO 32
      DO 103 KEO=1,3
      RSMP=0.0
      SSMP=0.0
      DO 101 I=1,NNE
      A=ATM(I)*FNORM
      RSMP=RSMP+A*SR(I,KEO)
  101 SSMP=SSMP+A*S(I,KEO)
      IF (SSMP) 102,103,102
  102 RSSAMP(KEO)=RSMP/SSMP
  103 CONTINUE
   32 IF (.NOT. OXIDE .AND. ANIDE .EQ. 0) GO TO 31
      ARATIO=ASUM/ATW(SAN(NE1))
      RSUM=RSUM+ARATIO
      MAN=MAN+ARATIO*SAN(NE1)
      MAW=MAW+ASUM
   31 MAN=MAN/RSUM
      MAW=MAW/RSUM
      H=1.2*MAW/MAN**2
      WRITE(6,93) N,MAN,MAW,H,RSSAMP(1),RSSAMP(2),RSSAMP(3),SIDE,SIDE
   93 FORMAT('0','ITERATION',8X,'MEAN ATOMIC NUMBER    MEAN ATOMIC ',
     * 'WEIGHT    H (1.2*MAW/MAN**2)',8X,'R/S'/
     * ' ',I5,15X,F9.5,12X,F10.5,12X,F10.6,11X,3F9.5/
     * '0','ELEMENT',5X,'X',10X,'F(X)',7X,'FL',8X,'PSR/R',6X,'ATNC',
     * 4X,'WT % ATOM',4X,'WT(',A2,')',2X,'(ST DEV/AVE)*',A2)
      KEO=1
      DO 4 J=1,NE                                                       0675
      IF(J.GT.NKEO(KEO)) KEO=KEO+1
      SUM=0.0                                                           0676
```

```
      DO 5 I=1,NNE
    5 SUM=SUM+MAC(SAN(I),SAN(J))*ATM(I)
      MACSUM(J)=SUM*FNORM
      X(J)=PCST*SUM*0.01*FNORM
      SUM=1.0+X(J)/SIG(J,KEO)
    4 FX(J)=(1.0+H)/(SUM*(1.0+H*SUM))
      KEO=1
      DO 20 J=1,NE
      IF(J.GT.NKEO(KEO)) KEO=KEO+1
      ASUM=0.0
      SANJ=SAN(J)
      IF (SANJ .LT. 12 .OR. SANJ .GT. 39) GO TO 21
      CC=CI(SANJ,1)/CI(SANJ,2)
      NN=NI(SANJ,1)-NI(SANJ,2)
      KEDGE=R(SANJ,1)
      M=0
      UA=EOO(KEO)/EC(J)
      UA=UA*ALOG(UA)-UA+1.0
      DO 22 I=1,NE
      K=ANINDX(I)
      SANI=SAN(K)
      IF (SANI .EQ. SANJ .OR. SANI .LT. 12 .OR. SANI .GT. 39 .OR.
     1 KA(SANI) .GE. KEDGE) GO TO 22
      WK=(AWK+SANI*(BWK+CWK*SANI*SANI))**4
      WK=WK/(1.0+WK)*0.5
      RR=CC*WL(SANI)**NN
      RR=(RR-1.0)/RR
      UB=EOO(KEO)/EC(K)
      UB=UB*ALOG(UB)-UB+1.0
      V=SIG(K,KEO)/MACSUM(K)
      V=ALOG(1.0+V)/V
      U=MACSUM(J)/(MACSUM(K)*SINTHE)
      U=ALOG(1.0+U)/U
      ASUM=ASUM+WK*ATM(K)*RR*ATW(SANJ)/ATW(SANI)*(EC(K))**0.3*
     1 MAC(SANI,SANJ)/MACSUM(K)*UB/UA*(U+V)
      M=M+1
   22 CONTINUE
   21 KF(J)=ASUM*FNORM
      RSAMP(J)=FX(J)*(1.0+KF(J))
      RATIO(J)=RSTAND(J)/RSAMP(J)
      ANCORR=1.0
      IF (ATNCOR) ANCORR=RSSTND(J)/RSSAMP(KEO)
      ANC(J)=ANCORR
   20 ATM1(J)=ATMC(J)*RATIO(J)*ANCORR
      ASUM=100.0-ATM(NE1)
      OSUM=0.0
      IF (OXIDE .OR. (ANIDE .NE. 8 .AND. ANIDE .NE. 0)) GO TO 6
      GO TO 7
    6 DO 8 J=1,NE
      OX(J)=ATM(J)*(VIDE*ATW(SAN(J))+VAL(J)*ATW(ANIDE))/(VIDE*ATW(SAN(J)
     1 ))
      IF (SAN(J) .EQ. ANIDE) OX(J)=0.0
    8 OSUM=OSUM+OX(J)
    7 IF (.NOT. OXIDE .AND. ANIDE .EQ. 0) GO TO 13
      DO 9 J=1,NE
      OXER(J)=OX(J)*STDERR(J)
      WRITE(6,92) SAS(J),X(J),FX(J),KF(J),RATIO(J),ANC(J),ATM(J),
     * OX(J),OXER(J)
   92 FORMAT(' ',2X,A2,4X,3F11.6,2F10.5,2(F10.4,1X),F12.6)
    9 CONTINUE
      WRITE(6,94) ASUM,OSUM
   94 FORMAT(' ',61X,2(F10.4,1X))
      GO TO 14
```

```
   13 DO 15 J=1,NE
      OXER(J)=ATM(J)*STDERR(J)
      WRITE(6,92) SAS(J),X(J),FX(J),KF(J),RATIO(J),ANC(J),ATM(J),
     * OX(J),OXER(J)
   15 CONTINUE
      WRITE(6,94) ASUM,OSUM
   14 DO 11 J=1,NE
      IF (ABS(ATM(J)-ATM1(J)) .GT. 0.01) GO TO 2
   11 CONTINUE
      GO TO 9999
    2 CONTINUE
 9999 CONTINUE
      RETURN
      END
/*
//MG9931LD JOB (927020077,C922,6,20),'CALK',CLASS=D
//JOBLIB DD DSN=SYS1.LOADLIB,DISP=SHR
// EXEC PGM=C922,REGION=225K,TIME=3
//FT06F001 DD SYSOUT=A
//FT05F001 DD *
 &ACOEF
    CI=    2*0.0,   0.135,   0.350,   0.740,   1.350,   2.210,   3.800,   4.900,
   6.770,   9.050,  11.750,  14.870,  18.500,  22.500,  27.000,  31.700,  36.900,
  42.500,  48.400,  55.100,  62.100,  69.800,  78.000,  86.700,  95.800,105.500,
 115.900,126.800,138.000,149.800,162.200,175.400,189.400,205.000,219.300,
 235.500,251.300,268.100,  66*0.0,
 11*0.0,
   0.89,   1.18,   1.54,   1.96,   2.43,   2.98,   3.62,   4.31,   5.10,   5.99,   7.00,
   8.02,   9.18,  10.45,  11.75,  13.25,  14.80,  16.45,  18.25,  20.20,  22.15,  24.25,
  26.40,  28.80,  31.25,  33.90,  36.50,  39.30,  42.30,  45.50,  48.50,  52.10,  55.60,
  59.30,  63.10,  67.30,  71.00,  75.50,  79.60,  84.20,  88.50,  94.00,  98.30,103.40,
 109.00,114.40,120.00,125.50,132.00,138.50,143.50,150.00,157.00,163.50,170.50,
 176.50,184.00,192.50,199.00,206.00,214.00,222.00,231.00,239.00,247.00,256.00,
 263.00,272.00,281.00,289.00,298.00,307.00,316.00,325.00,    20*0.0,
                                          28*0.0,    14.06,  15.60,  17.25,  18.95,  20.75,
  22.55,  24.60,  26.70,  28.80,  31.20,  33.50,  36.15,  38.90,  41.45,  44.50,  47.50,
  50.70,  53.95,  57.50,  60.70,  64.50,  68.00,  71.95,  75.65,  80.35,  84.00,  88.40,
  93.15,  97.80,102.50,107.30,112.80,118.50,122.50,128.00,134.00,140.00,146.00,
 151.00,157.00,165.00,170.00,176.00,183.00,190.00,197.00,204.00,211.00,219.00,
 225.00,232.00,240.00,247.00,255.00,262.00,270.00,278.00,286.00,    19*0.0,
                                                       29*0.0,  11.20,  12.40,  13.60,  14.90,
  16.20,  17.70,  19.15,  20.80,  22.40,  24.10,  25.95,  27.90,  29.75,  31.95,  34.10,
  36.40,  38.70,  41.30,  43.60,  46.30,  48.80,  51.70,  54.30,  57.70,  60.30,  63.40,
  66.90,  70.20,  73.60,  77.00,  81.00,  85.00,  88.00,  92.00,  96.30,100.30,104.50,
 108.50,113.00,118.00,122.00,126.00,131.00,136.00,142.00,147.00,152.00,157.00,
 161.00,167.00,172.00,177.00,183.00,188.00,194.00,199.00,205.00,210.00,  18*0.0,
                                                                         32*0.0,   4.28,
   4.69,   5.13,   5.60,   6.10,   6.62,   7.18,   7.78,   8.39,   9.05,   9.74,  10.47,
  11.24,  12.03,  12.87,  13.76,  14.68,  15.65,  16.66,  17.72,  18.82,  19.97,  21.16,
  22.41,  23.70,  25.05,  26.47,  27.93,  29.44,  31.01,  32.63,  34.31,  36.06,  37.86,
  39.76,  41.69,  43.69,  45.79,  47.92,  50.13,  52.44,  54.79,  57.21,  59.70,  62.27,
  64.92,  67.64,  70.55,  73.60,  76.64,  79.94,  83.51,  87.27,  91.21,  95.35,  99.70,
 104.30,109.40,114.50,120.70,127.10,135.40,   11*0.0,
  54*0.0,        18.2,  19.3,  20.4,  21.6,  22.8,  24.1,  25.4,  26.7,  28.1,  29.6,  31.1,
  32.6,  34.3,  35.9,  37.7,  39.6,  41.3,  43.2,  45.2,  47.2,  49.3,  51.5,  53.7,  56.0,
  58.3,  60.8,  63.5,  66.1,  68.9,  72.0,  75.2,  78.5,  82.2,  86.0,  89.9,  94.3,  98.7,
 104.0,109.5,116.5,  11*0.0,
                                               55*0.0,      16.0,16.9,17.9,18.9,20.0,
 21.0,22.2,23.3,24.5,25.8,27.0,28.5,29.8,31.2,32.7,34.2,35.8,37.5,39.1,40.9,
 42.6,44.5,46.4,48.3,50.4,52.6,54.7,57.1,59.7,62.3,65.2,68.1,71.2,74.5,78.1,
 81.8,86.2,90.8,96.7,  11*0.0,
                                                              57*0.0,    15.5,16.3,17.2,
 18.2,19.1,20.1,21.2,22.3,23.4,24.5,25.7,27.0,28 3,29.6,30.9,32.4,33.8,35.3,
```

```
36.9,38.4,40.1,41.8,43.6,45.4,47.3,49.3,51.6,53.9,56.3,58.9,61.5,64.4,67.5,
70.7,74.5,78.5,83.6, 11*0.0,
   105*0.0,
                                                   62*0.0,   13.85,14.30,14.80,
15.30,15.85,16.30,16.85,17.45,18.00,18.55,19.05,19.60,20.10,20.45,21.35,21.95,
22.50,23.10,23.80,24.40,25.10,25.80,26.60,27.40,28.30,29.60,30.80,31.30,32.40,
33.60,34.90,36.40,11*0.0,
NI= 2*0.0,2.88,2.86,2.85,2.84,2.83,2.82,2.81,2.80,2.79,2.79,2.78,2.77,2.77,
2.76,2.76,2.75,2.75,2.74,2.74,2.73,2.73,2.73,2.72,2.72,2.71,2.71,2.71,2.70,
2.70,2.70,2.69,2.69,2.69,2.68,2.68,2.68,2.67,   66*0.0,
                                              11*0.0,   2.73,2.73,2.73,2.73,
2.73,2.73,2.73,2.73,2.73,2.73,2.73,2.73,2.73,2.73,2.73,2.73,2.73,2.73,2.73,
2.73,2.73,2.73,2.73,2.73,2.73,2.73,2.73,2.73,2.73,2.73,2.72,2.72,2.72,2.72,
2.72,2.71,2.71,2.71,2.71,2.70,2.70,2.70,2.69,2.69,2.69,2.68,2.68,2.68,2.67,
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2.60,2.60,2.59,2.59,2.58,2.58,2.57,2.56,2.56,2.55,  20*0.0,
R= 5*0.0, 44.2775, 30.99425, 23.3918, 17.96768, 0.0, 11.480,
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 2.269, 2.070, 1.896, 1.743, 1.608, 1.488, 1.380, 1.283, 1.196, 1.117, 1.045,
 0.980, 0.920, 0.866, 0.816, 0.770, 0.728, 66*0.0,
                      11*0.0,17*12.0,       11.270,10.330, 9.540, 8.730, 8.107,
 7.506, 6.970, 6.460, 5.998, 5.583, 5.232, 4.867, 4.581, 4.298, 4.060, 3.830,
 3.626, 3.428, 3.254, 3.085, 2.926, 2.777, 2.639, 2.511, 2.389, 2.274, 2.167,
 2.068, 1.973, 1.889, 1.811, 1.735, 1.665, 1.599, 1.536, 1.477, 1.421, 1.365,
 1.317, 1.268, 1.222, 1.182, 1.140, 1.100, 1.061, 1.025, 0.990, 0.956, 0.923,
 0.893, 0.863, 0.835, 0.808, 0.782, 0.757, 0.732, 0.709, 0.700,    19*0.0,
                              28*0.0,       12.000,11.870,10.930, 9.940, 9.124,
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 1.390, 1.338, 1.288, 1.243, 1.199, 1.155, 1.114, 1.075, 1.037, 1.001, 0.967,
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                                     29*0.0,      12.000,11.100,10.190, 9.390,
 8.670, 8.000, 7.430, 6.890, 6.387, 5.961, 5.538, 5.223, 4.913, 4.632, 4.369,
 4.130, 3.908, 3.698, 3.504, 3.324, 3.156, 3.000, 2.855, 2.719, 2.592, 2.474,
 2.363, 2.258, 2.164, 2.077, 1.995, 1.918, 1.845, 1.755, 1.710, 1.649, 1.579,
 1.535, 1.482, 1.433, 1.386, 1.341, 1.297, 1.255, 1.216, 1.177, 1.140, 1.106,
 1.072, 1.040, 1.008, 0.979, 0.950, 0.923, 0.897, 0.872, 0.848, 0.825, 0.803,
 0.782, 0.761, 0.741, 0.722, 0.704, 0.700, 11*0.0,
          32*0.0,22*12.0,     10.202,
 9.557, 9.042, 8.614, 8.188, 7.831, 7.513, 7.178, 6.856, 6.566, 6.292, 6.088,
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 3.774, 3.620, 3.482, 3.349, 3.218, 3.099, 2.987, 2.876, 2.767, 2.672, 2.577,
 2.484, 2.401, 2.313, 2.235, 2.160, 2.090, 11*0.0,
   54*0.0,  12.0,
10.845,10.321, 9.692, 9.258, 8.773, 8.376, 8.023, 7.642, 7.322, 7.011, 6.715,
 6.453, 6.179, 5.931, 5.686, 5.475, 5.211, 5.015, 4.823, 4.625, 4.443, 4.273,
 4.114, 3.939, 3.779, 3.632, 3.484, 3.355, 3.228, 3.099, 2.987, 2.876, 2.773,
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55*0.0,2*12.0,10.408, 9.957, 9.499, 9.115, 8.705, 8.331, 7.997, 7.685, 7.383,
 7.128, 6.834, 6.559, 6.331, 6.112, 5.861, 5.637, 5.451, 5.253, 5.060, 4.873,
 4.710, 4.522, 4.349, 4.201, 4.042, 3.902, 3.768, 3.635, 3.512, 3.387, 3.279,
 3.170, 3.080, 2.980, 2.882, 2.798, 2.718, 11*0.0,
   57*0.0,  5*12.0,                              10.604,10.111, 9.692, 9.258,
 8.899, 8.508, 8.155, 7.836, 7.545, 7.190, 6.898, 6.640, 6.357, 6.106, 5.880,
 5.665, 5.415, 5.280, 4.998, 4.797, 4.612, 4.443, 4.274, 4.118, 3.960, 3.826,
 3.689, 3.573, 3.443, 3.300, 3.220, 3.114, 11*0.0,
                          62*0.0,                10.893,10.408, 9.957, 9.528,
 9.155, 8.773, 8.433, 8.086, 7.777, 7.427, 7.128, 6.871, 6.594, 6.357, 6.094,
 5.880, 5.629, 5.413, 5.200, 4.994, 4.808, 4.625, 4.459, 4.304, 4.146, 4.012,
 3.874, 3.745, 3.614, 3.496, 3.387, 3.279, 11*0.0,
 63*0.0,24*12.0,10.330,9.917,9.492,9.048,8.614,8.264,7.946,11*0.0,
  ATW=                  1.00797,4.0026,6.939,9.0122,10.811,12.01115,
```

(19)

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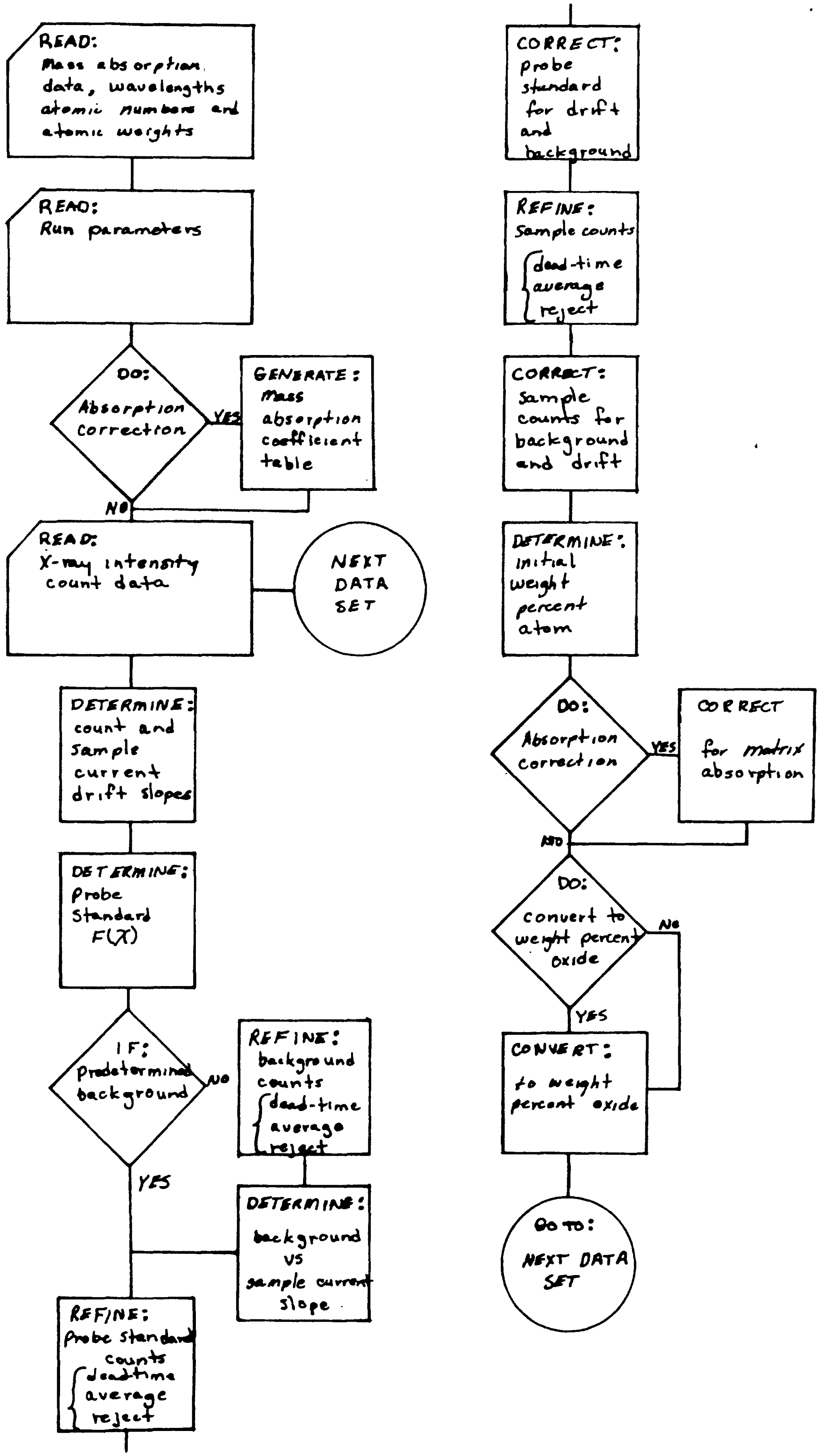
 14.0067,15.9994,18.9984,20.183,22.9898,24.312,26.9815,28.086,30.9738,
 32.064,35.453,39.948,39.102,40.08,44.956,47.90,50.942,51.996,54.9380,
 55.847,58.9332,58.71,63.54,65.37,69.72,72.59,74.9216,78.96,79.909,
 83.80,85.47,87.62,88.905,91.22,92.906,95.94,      0.0,101.07,102.905,
 106.4,107.870,112.40,114.82,118.69,121.75,127.60,126.9044,131.30,
 132.905,137.34,138.91,140.12,140.907,144.24,      0.0,150.35,151.96,
 157.25,158.924,162.50,164.930,167.26,168.934,173.04,174.97,178.49,
 180.948,183.85,186.2,190.2,192.2,195.09,196.967,200.59,204.37,207.19,
 208.980,   6*0.0,232.038,  0.0,    238.030,  13*0.0,
 WL= 4*0.0,67.0,44.0,31.6037,23.7077,18.3069,14.6150,
                11.909,9.889,8.337,7.126,6.155,5.373,4.728,4.193,3.742,
3.359,3.032,2.748,2.504,2.291,2.103,1.937,1.790,1.659,1.542,1.436,
1.341,1.255,1.177,1.106,1.041,0.000,7.318,6.863,6.449,6.070,5.724,
5.406,0.000,4.846,4.597,4.368,4.154,3.956,3.772,3.600,3.439,3.289,
3.148,0.000,2.892,2.775,2.665,2.561,2.463,2.370,2.283,2.199,2.121,
2.046,1.975,1.909,1.845,1.784,1.726,1.672,1.619,1.570,1.522,1.476,
1.433,1.391,1.351,1.313,1.276,1.241,1.207,1.175,4.909,
     6*0.0,                   3.942,3.827,3.715,  13*0.0,
KA= 10*0.0,11.909,9.889,8.337,7.126,6.155,5.373,4.728,4.193,3.742,3.359,3.032,
2.748,2.504,2.291,2.103,1.937,1.790,1.659,1.542,1.436,1.341,1.255,1.177,1.106,
1.041,0.981,0.927,0.876,0.830,0.787,0.746,0.710,63*0.0,
&END
/*
/*
```

FLOW DIAGRAM



APPENDIX C

RUN PARAMETERS SHEET FOR MICROPROBE DATA REDUCTION # 9877 — 1/5

Identification

CHROMITE FROM STILLWATER COMPLEX 55G IA JULY 20 1967

operating KV	Probe const.	Integration time	options
15.0	1.6071	20	T T T F I 3

options available

5.3 absorption correction (T or F)	59 reject readings with $N-\bar{N} > \pm 2.5\sqrt{\bar{N}}$
5.5 conversion to weight percent oxide (T or F)	61 number of standards used for determing atomic weight percent
5.7 Predetermined background (T or F)	63-64 total number of standards used for the analysis

DEADTIME (no. 8)

	element 1	element 2	element 3	element 4	element 5	element 6	element 7	element 8	element 9
DEADTIME	0.0 E	0.0 E	0.0 E	0.0 E	0.0 E	0.0 E	0.0 E	0.0 E	. E

	no.	element 1	element 2	element 3	element 4	element 5	element 6	element 7	element 8	element 9
BACKGROUND	8	5.5	11.0	9.5	6.0	10.0	7.5	12.0	7.5	.
VALENCES	8	MG+2	CR+3	FE+2	AL+3	TI+3	MN+2	V +3	NI+2	

COMP PS07	8	AL 7.62	FE 29.85	MG 4.34	MN .15	NI .12	CR 25.05	TI .55
COMP PS07		Ø 32.05	V .12	.	.	.	.	.
COMP PS08	8	AL 6.67	FE 27.33	MG 5.19	MN .12	NI .10	CR 27.85	TI .48
COMP PS08		Ø 32.16	V .12	.	.	.	.	.
COMP PS10	8	AL 6.88	FE 21.84	MG 3.95	MN .24	NI .07	CR 33.67	TI .96
COMP PS10		Ø 32.16	V .14	.	.	.	.	.

Sample data sheets

2/5

3976	0	29735	0	17692	0	501	3	011320	2011 0307	CT STD 7	Data set for first standardization for Mg and Fe	
3973	0	30444	0	17624	0	501	3	011340				
3882	0	30102	0	17416	0	502	3	011400				
3854	0	30060	0	17524	0	503	3	011420				
									0 ← end of data set flag			
4826	0	33127	0	16173	0	500	3	011440	2020 2008	CT STD 8	Data set for first standardization for Cr.	
4908	0	31690	0	16219	0	509	3	011500				
4847	0	34019	0	16165	0	512	3	011520				
4763	0	33919	0	16208	0	513	3	011540				
									0			
3739	0	27508	0	17981	0	491	3	011800	191123	55G 1A 1	Data set for first sample for Mg, Cr and Fe	
3612	0	28035	0	18095	0	493	3	011820				FIRST
3781	0	28024	0	18116	0	496	3	011840				
3666	0	27217	0	18283	0	493	3	011900				DATA
									0			
3622	0	28713	0	17813	0	497	3	012000	102123	55G 1A 2	Data set for second sample for Mg, Cr and Fe.	GROUP
3777	0	28878	0	17611	0	496	3	012020				
3921	0	28206	0	18013	0	496	3	012040				
3847	0	28581	0	17657	0	503	3	012100				
									0			
2923	0	23743	0	19570	0	507	3	012120	103123	55G 1A 3	Data set for third sample for Mg, Cr and Fe.	
2876	0	23299	0	19584	0	508	3	012140				
2741	0	24660	0	19980	0	508	3	012200				
2881	0	25670	0	19522	0	507	3	012220				
									0			
3898	0	28509	0	18045	0	509	3	012700	2031 0307	CT STD 7	Data set for second standardization for Mg and Fe	
4055	0	30204	0	18351	0	518	3	012720				
4110	0	30746	0	18693	0	520	3	012740				
4035	0	28846	0	17846	0	526	3	012800				
									0			

3/5

4954	0	32100	0	16785	0	520	3	013200	204020 8	CT STD 8	Data set for second	FIRST
5038	0	30644	0	16883	0	520	3	013220			standardization for	DATA
4976	0	32896	0	16777	0	518	3	013240			Cr.	GROUP
4889	0	32800	0	16821	0	516	3	013300				(cont'd)
									8 ← end of data group flag			
15847	0	934	0	242	0	500	3	014800	201400 7	CT STD 7	Data set for first	
15493	0	890	0	205	0	502	3	014820			standardization for	
16072	0	976	0	261	0	500	3	014840			Al	
15988	0	832	0	201	0	495	3	014900				
16423	0	851	0	195	0	501	3	014920				
									0			
14005	0	1453	0	260	0	507	3	014940	20205610	CT STD10	Data set for first	
13478	0	1506	0	408	0	507	3	014500			standardization for	SECOND
13102	0	1427	0	290	0	508	3	015020			Ti and Mn.	
13968	0	1564	0	297	0	508	3	015040				DATA
									0			
18163	0	917	0	279	0	496	3	015200	101456	556 1A 1	Data set for first	GROUP
18005	0	1037	0	357	0	500	3	015220			sample for Al, Ti	
18278	0	968	0	457	0	502	3	015240			and Mn.	
18823	0	1061	0	425	0	503	3	015300				
									0			
19284	0	1041	0	270	0	516	3	015320	102456	556 1A 2	Data set for second	
19106	0	1084	0	229	0	518	3	015320			sample for Al, Ti	
19619	0	1077	0	260	0	520	3	015400			and Mn.	
19252	0	1053	0	480	0	521	3	015420				
									0			
19614	0	1091	0	275	0	516	3	015440	103456	556 1A 3	Data set for third	
19712	0	1043	0	280	0	518	3	015500			sample for Al, Ti	
19439	0	1068	0	289	0	520	3	015520			and Mn.	
19871	0	1031	0	259	0	521	3	015540				

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									0			
15626	0	885	0	264	0	511	3	020100	203400 7	CT STD 7	Data set for second	
15722	0	870	0	251	0	518	3	020120			standardization for	SECOND
16340	0	918	0	225	0	519	3	020240			Al.	
15070	0	812	0	289	0	521	3	020300				DATA
									0			
13779	0	1400	0	302	0	512	3	020400	20405610	CT STD10	Data set for second	GROUP
13260	0	1451	0	474	0	524	3	020420			standardization for	
12890	0	1375	0	337	0	525	3	020440			Ti and Mn.	(cont'd)
13743	0	1596	0	345	0	523	3	020500				
									8			
16048	0	322	0	215	0	501	3	022000	201078 7	CT STD 7	Data set for first	
16226	0	339	0	174	0	499	3	022020			standardization for	
16191	0	290	0	236	0	497	3	022040			V and Ni.	
16416	0	302	0	225	0	497	3	022100				
15047	0	313	0	173	0	501	3	022120				
									0			THIRD
19245	0	335	0	213	0	525	3	022320	101078	556 1A 1	Data set for first	
19331	0	356	0	263	0	524	3	022340			sample for V and Ni.	DATA
19274	0	364	0	225	0	527	3	022400				
19328	0	376	0	215	0	512	3	022420				GROUP
									0			
18483	0	324	0	19800		512	3	022440	102078	556 1A 2	Data set for second	
19089	0	302	0	187	0	511	3	022500			sample for V and Ni.	
18460	0	347	0	206	0	510	3	022520				
18552	0	289	0	188	0	507	3	022540				
									0			
19405	0	332	0	162	0	508	3	022600	103078	556 1A 3	Data set for third	
19536	0	330	0	235	0	507	3	022620			sample for V and Ni.	
19256	0	332	0	321	0	508	3	022640				

5/5

```
 20689  0     327  0     203  0     507 3  022700 103078     55G  1A  3
                                                  0                          THIRD
 15614  0     284  0     227  0     500 3  023200 202078 7   CT  STD  7
 14172  0     279  0     213  0     501 3  023220                            DATA
 11667  0     281  0     218  0     506 3  023240
 13874  0     367  0     228  0     507 3  023400                            GROUP
 14820  0     344  0     273  0     508 3  023420
 15833  0     322  0     214  0     503 3  023440                            (cont'd)
                                                  8
                                                  9 ← end of run flag
```

Data set for second standardization for V and Ni

Sample output

```
CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967

OPERATING KILOVOLTAGE=     15.0    PROBE CONSTANT=  1.6071    COUNTING TIME=  20.
T ABSORPTION CORRECTION
T CONVERSION TO WEIGHT PER CENT OXIDE
T PREDETERMINED BACKGROUND
1 NUMBER OF STANDAROS USED FOR OETERMINING ATOMIC WEIGHT PER CENT
F REJECTION OF VALUES MORE THAN 2.5*SORT(VALUE) FROM THE MEAN

DEADTIME
 D.0          0.0          0.0          0.0          0.0          0.0          0.0          0.0

PREDETERMINED BACKGROUND
  5.50 11.00  9.50  6.00 10.00  7.50 12.00  7.50

VALENCES
 MG 2 CR 3 FE 2 AL 3 TI 3 MN 2 V  3 NI 2

STANDARO COMPOSITION
 PS  7  AL    7.62 FE  29.85 MG    4.34 MN    0.15 NI    0.12 CR  25.05 TI    0.55 O   32.05 V     0.12
 PS  8  AL    6.67 FE  27.33 MG    5.19 MN    0.12 NI    0.10 CR  27.85 TI    0.48 O   32.16 V     0.12
 PS 10  AL    6.88 FE  21.84 MG    3.95 MN    0.24 NI    0.07 CR  33.67 TI    0.96 O   32.16 V     0.54

MASS ABSORPTION COEFFICIENTS
                                      EMITTERS

ABSORBER        MG          CR          FE         AL          TI          MN          V          NI
   MG       463.6123    118.7155     74.3239  4361.6836    197.1938     93.4888   152.1344     48.2401
   CR      4781.9766     88.2491    474.1958  3000.5305    144.9964     69.8544   112.4900    310.6521
   FE      6120.7227    112.9551     71.4333  3840.5488    185.5891     89.4106   143.9823    379.6177
   AL       614.6768    148.9979     93.4395   385.6887    247.0452    117.4367   190.7718     60.7412
   TI      3646.3899    596.9792    377.5327  2287.9866    110.5637    472.5442    85.7767    247.3270
   MN      5443.5391    100.4579     63.5301  3415.6370    165.0558     79.5183   128.0524    343.5581
   V       4177.7187     77.0978    424.3442  2621.3787    126.6744    531.1365    98.2756    277.9939
   NI      7709.5078    142.2753     89.9756  4837.4570    233.7632    112.6192   181.3565     58.9443
   O       2432.8335     39.3599     24.5182  1503.2456     65.7369     30.9165    50.5745     15.839
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CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION  STANDARD    CT STD 7

      COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

     MG            CR            FE       SAMPLE CURRENT    TIME
  1.9880E 02   1.4832E 03   8.8460E 02     5.01E-01            0
  1.9865E 02   1.5195E 03   8.8120E 02     5.01E-01           20
  1.9410E 02   1.5033E 03   8.7080E 02     5.02E-01           40
  1.9270E 02   1.5021E 03   8.7620E 02     5.03E-01           60

AVERAGE
  1.9606E 02   1.5020E 03   8.7820E 02     5.02E-01

STANDARD OEVIATION
  3.1277E 00   1.4833E 01   6.0200E 00

BACKGROUNO CORRECTEO COUNT
  1.9056E 02   1.4910E 03   8.6870E 02     5.02E-01

*******************************************************************************************************

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IOENTIFICATION  STANOARD    CT STD 8

      COUNTS PER SECOND CORRECTEO FOR OEAO TIME ANO ORIFT

     MG            CR            FE       SAMPLE CURRENT    TIME
  2.4130E 02   1.6563E 03   8.0865E 02     5.03E-01           80
  2.4540E 02   1.5854E 03   8.1095E 02     5.09E-01          100
  2.4235E 02   1.7030E 03   8.0825E 02     5.12E-01          120
  2.3815E 02   1.6990E 03   8.1040E 02     5.13E-01          140

AVERAGE
  2.4180E 02   1.6609E 03   8.0956E 02     5.09E-01

STANOARO OEVIATION
  2.9908E 00   5.4569E 01   1.3143E 00

BACKGROUND CORRECTED COUNT
  2.3630E 02   1.6499E 03   8.0006E 02     5.09E-01

*******************************************************************************************************

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION  STANOARO    CT STO 7

      COUNTS PER SECOND CORRECTED FOR OEAO TIME ANO ORIFT

     MG            CR            FE       SAMPLE CURRENT    TIME
  1.9490E 02   1.4573E 03   9.0225E 02     5.09E-01          820
  2.0275E 02   1.5449E 03   9.1755E 02     5.18E-01          840
  2.0550E 02   1.5736E 03   9.3465E 02     5.20E-01          860
  2.0175E 02   1.4772E 03   8.9230E 02     5.26E-01          880

AVERAGE
  2.0122E 02   1.5132E 03   9.1169E 02     5.18E-01
```

STANDARD DEVIATION
4.5049E 00   5.4974E 01   1.8499E 01

BACKGROUND CORRECTED COUNT
1.9572E 02   1.5022F 03   9.0219E 02   5.18E-01

****

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION STANDARD CT STD 8

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

MG	CR	FE	SAMPLE CURRENT	TIME
2.4770E 02	1.6559E 03	8.3925E 02	5.20E-01	1120
2.5190E 02	1.5817E 03	8.4165E 02	5.20E-01	1140
2.4880E 02	1.6990E 03	8.3885E 02	5.18E-01	1160
2.4445E 02	1.6951F 03	8.4105E 02	5.16E-01	1180

AVERAGE
2.4821E 02   1.6579E 03   8.4020E 02   5.19E-01

STANDARD DEVIATION
3.0747E 00   5.4401E 01   1.3602E 00

BACKGROUND CORRECTED COUNT
2.4271E 02   1.6469E 03   8.3070E 02   5.19E-01

****

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION SAMPLE 55G 1A 1

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

MG	CR	FE	SAMPLE CURRENT	TIME
1.8695E 02	1.3836E 03	8.9905E 02	4.91F-01	280
1.8060E 02	1.4109E 03	9.0475E 02	4.93E-01	300
1.8905E 02	1.4112E 03	9.0580E 02	4.96E-01	320
1.8330E 02	1.3714E 03	9.1415E 02	4.93E-01	340

AVERAGE
1.8497E 02   1.3943E 03   9.0594E 02   4.93E-01

STANDARD DEVIATION
3.7618E 00   2.0018E 01   6.2267E 00

BACKGROUND CORRECTED COUNT
1.7947E 02   1.3833E 03   8.9644E 02   4.93E-01

****

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION SAMPLE 55G 1A 2

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

MG	CR	FE	SAMPLE CURRENT	TIME
1.8110E 02	1.4494E 03	8.9065E 02	4.97E-01	400
1.8885E 02	1.4586E 03	8.8055E 02	4.96E-01	420
1.9605E 02	1.4255E 03	9.0065E 02	4.96E-01	440
1.9235E 02	1.4453E 03	8.8285E 02	5.03E-01	460

AVERAGE
1.8959E 02   1.4447E 03   8.8867E 02   4.98E-01

STANDARD DEVIATION
6.3764E 00   1.3952E 01   9.0784E 00

BACKGROUND CORRECTED COUNT
1.8409E 02   1.4337E 03   8.7917E 02   4.98E-01

****

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION SAMPLE 55G 1A 3

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

MG	CR	FE	SAMPLE CURRENT	TIME
1.4615E 02	1.2013E 03	9.7850E 02	5.07E-01	480
1.4380E 02	1.1796E 03	9.7920E 02	5.08E-01	500
1.3705E 02	1.2492E 03	9.9900E 02	5.08E-01	520
1.4405E 02	1.3012E 03	9.7610E 02	5.07E-01	540

AVERAGE
1.4276E 02   1.2328E 03   9.8320E 02   5.08E-01

STANDARD DEVIATION
3.9514E 00   5.4060E 01   1.0617E 01

BACKGROUND CORRECTED COUNT
1.3726E 02   1.2218E 03   9.7370E 02   5.08E-01

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION STANDARD CT STD 7

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

AL	TI	MN	SAMPLE CURRENT	TIME
7.6735E 02	4.6515E 01	1.2317E 01	5.00E-01	0
7.7465E 02	4.4359E 01	1.0396E 01	5.02E-01	20
8.0360E 02	4.8684E 01	1.3189E 01	5.00E-01	40
7.9940E 02	4.1534E 01	1.0121E 01	4.95E-01	60
8.2115E 02	4.2516E 01	9.7844E 00	5.01E-01	80

AVERAGE

AL	TI	MN	SAMPLE CURRENT
7.9323E 02	4.4721E 01	1.1161E 01	5.00E-01

STANDARD DEVIATION

AL	TI	MN
2.2023E 01	2.9185E 00	1.5008E 00

BACKGROUND CORRECTED COUNT

AL	TI	MN	SAMPLE CURRENT
7.8723E 02	3.4721E 01	3.6615E 00	5.00E-01

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION STANDARD CT STD10

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

AL	TI	MN	SAMPLE CURRENT	TIME
7.0025E 02	7.2650E 01	1.3000E 01	5.07E-01	100
6.7390E 02	7.5360E 01	2.0329E 01	5.07E-01	120
6.5510E 02	7.1464E 01	1.4399E 01	5.08E-01	140
6.9840E 02	7.8387E 01	1.4695E 01	5.08E-01	160

AVERAGE

AL	TI	MN	SAMPLE CURRENT
6.8191E 02	7.4465E 01	1.5606E 01	5.08E-01

STANDARD DEVIATION

AL	TI	MN
2.1535E 01	3.0815E 00	3.2342E 00

BACKGROUND CORRECTED COUNT

AL	TI	MN	SAMPLE CURRENT
6.7591E 02	6.4465E 01	8.1055E 00	5.08E-01

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION STANDARD CT STD 7

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

AL	TI	MN	SAMPLE CURRENT	TIME
7.8130E 02	4.5482E 01	1.1790E 01	5.11E-01	780
7.8610E 02	4.4747E 01	1.1175E 01	5.18E-01	800
8.1700E 02	4.7371E 01	9.8933E 00	5.19E-01	880
7.5350E 02	4.1936E 01	1.2668E 01	5.21E-01	900

AVERAGE

AL	TI	MN	SAMPLE CURRENT
7.8447E 02	4.4884E 01	1.1382E 01	5.17E-01

STANDARD DEVIATION

AL	TI	MN
2.6013E 01	2.2549E 00	1.1662E 00

BACKGROUND CORRECTED COUNT

AL	TI	MN	SAMPLE CURRENT
7.7847E 02	3.4884E 01	3.8816E 00	5.17E-01

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION STANDARD CT STD10

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

AL	TI	MN	SAMPLE CURRENT	TIME
6.8895E 02	7.2482E 01	1.3117E 01	5.12E-01	960
6.6300E 02	7.5185E 01	2.0524E 01	5.24E-01	980
6.4450E 02	7.1306E 01	1.4548E 01	5.25E-01	1000
6.8715E 02	7.8164E 01	1.4848E 01	5.23E-01	1020

AVERAGE

AL	TI	MN	SAMPLE CURRENT
6.7090E 02	7.4284E 01	1.5759E 01	5.21E-01

STANDARD DEVIATION

AL	TI	MN
2.1207E 01	3.0540E 00	3.2653E 00

BACKGROUND CORRECTED COUNT

AL	TI	MN	SAMPLE CURRENT
6.6490E 02	6.4284E 01	8.2593E 00	5.21E-01

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION SAMPLE 55G 1A 1

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

AL	TI	MN	SAMPLE CURRENT	TIME
9.0815E 02	4.6107E 01	1.3615E 01	4.96E-01	240
9.0025E 02	5.2182E 01	1.7362E 01	5.00E-01	260
9.1390E 02	4.8749E 01	2.2149E 01	5.02E-01	280
9.4115E 02	5.3476E 01	2.0528E 01	5.03E-01	300

AVERAGE

AL	TI	MN	SAMPLE CURRENT
9.1586E 02	5.0129E 01	1.8413E 01	5.00E-01

STANDARD DEVIATION

AL	TI	MN
1.7763E 01	3.3416E 00	3.7665E 00

BACKGROUND CORRECTED COUNT

AL	TI	MN	SAMPLE CURRENT
9.0986E 02	4.0129E 01	1.0913E 01	5.00E-01

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION SAMPLE 55G 1A 2

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

AL	TI	MN	SAMPLE CURRENT	TIME
9.6420E 02	5.2510E 01	1.2997E 01	5.16E-01	320
9.5530E 02	5.4723E 01	1.0986E 01	5.18E-01	340
9.8095E 02	5.4413E 01	1.2432E 01	5.20E-01	360
9.6260E 02	5.3244E 01	2.2874E 01	5.21E-01	380

AVERAGE

9.6576E 02   5.3723E 01   1.4822E 01   5.19E-01

STANDARD DEVIATION
1.0841E 01   1.0292E 00   5.4341E 00

BACKGROUND CORRECTED COUNT
9.5976E 02   4.3723E 01   7.3223E 00   5.19E-01

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CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION   SAMPLE   55G 1A 3

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

AL	TI	MN	SAMPLE CURRENT	TIME
9.8070E 02	5.5210E 01	1.3061E 01	5.16E-01	400
9.8560E 02	5.2823E 01	1.3254E 01	5.18E-01	420
9.7195E 02	5.4133E 01	1.3635E 01	5.20E-01	440
9.9355E 02	5.2300E 01	1.2179E 01	5.21E-01	460

AVERAGE
9.8295E 02   5.3616E 01   1.3032E 01   5.19E-01

STANDARD DEVIATION
9.0452E 00   1.3125E 00   6.1676E-01

BACKGROUND CORRECTED COUNT
9.7695E 02   4.3616E 01   5.5324E 00   5.19E-01

****

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION   STANDARD   CT STD 7

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

	V	NI	SAMPLE CURRENT	TIME
8.0240E 02	1.6100E 01	1.0750E 01	5.01E-01	0
8.1130E 02	1.6950E 01	8.6766E 00	4.99E-01	20
8.0955E 02	1.4501F 01	1.1737E 01	4.97E-01	40
8.2080E 02	1.5101E 01	1.1160E 01	4.97E-01	60
7.5235E 02	1.5652E 01	8.5579E 00	5.01E-01	80

AVERAGE
7.9928E 02   1.5661E 01   1.0176E 01   4.99E-01

STANDARD DEVIATION
2.7043E 01   9.3741E-01   1.4663E 00

BACKGROUND CORRECTED COUNT
7.9928E 02   3.6608E 00   2.6762E 00   4.99E-01

****

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION   STANDARD   CT STD 7

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

	V	NI	SAMPLE CURRENT	TIME
5.8335E 02	1.4064E 01	9.8885E 00	5.06E-01	760
7.8070E 02	1.4214E 01	1.0347E 01	5.00E-01	720
7.0860E 02	1.3964E 01	9.6853E 00	5.01E-01	748
6.9370E 02	1.8370E 01	1.0242E 01	5.07E-01	840
7.4100E 02	1.7220E 01	1.2234E 01	5.08E-01	860
7.9165E 02	1.6119E 01	9.5669E 00	5.03E-01	880

AVERAGE
7.1650E 02   1.5658E 01   1.0327E 01   5.04E-01

STANDARD DEVIATION
7.5737E 01   1.8711E 00   9.8242E-01

BACKGROUND CORRECTED COUNT
7.1650E 02   3.6584E 00   2.8273E 00   5.04E-01

****

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION   SAMPLE   55G 1A 1

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

	V	NI	SAMPLE CURRENT	TIME
9.6225E 02	1.6754E 01	1.0371E 01	5.25E-01	200
9.6655E 02	1.7705E 01	1.2772E 01	5.24E-01	220
9.6370E 02	1.8206E 01	1.0898E 01	5.27E-01	240
9.6690E 02	1.8806E 01	1.0387E 01	5.12E-01	260

AVERAGE
9.6485E 02   1.7868E 01   1.1107E 01   5.22E-01

STANDARD DEVIATION
2.2491E 00   8.6822E-01   1.1367E 00

BACKGROUND CORRECTED COUNT
9.6485E 02   5.8680E 00   3.6068E 00   5.22E-01

****

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION SAMPLE 55G 1A 2

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

	V	NI	SAMPLE CURRENT	TIME
9.2415E 02	1.6206E 01	9.5405E 00	5.12E-01	280
9.5445E 02	1.5106E 01	8.9871E 00	5.11E-01	300
9.2300E 02	1.7357E 01	9.8747E 00	5.10E-01	320
9.2760E 02	1.4457E 01	8.9887E 00	5.07E-01	340

AVERAGE
9.3230E 02   1.5781E 01   9.3477E 00   5.10E-01

STANDARD DEVIATION
1.4895E 01   1.2748E 00   4.3734E-01

BACKGROUND CORRECTED COUNT
9.3230E 02   3.7815E 00   1.8477E 00   5.10E-01

****

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION SAMPLE 55G 1A 3

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

	V	NI	SAMPLE CURRENT	TIME
9.7025E 02	1.6608E 01	7.7257E 00	5.08E-01	360
9.7680E 02	1.6508E 01	1.1178E 01	5.07E-01	380
9.6280E 02	1.6609E 01	1.5230E 01	5.08E-01	400
1.0344E 03	1.6359E 01	9.6069E 00	5.07E-01	420

AVERAGE
9.8607E 02   1.6521E 01   1.0935E 01   5.08E-01

STANDARD DEVIATION
3.2753E 01   1.1781E-01   3.1922E 00

BACKGROUND CORRECTED COUNT
9.8607E 02   4.5210E 00   3.4352E 00   5.08E-01

****

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION SAMPLE 55G 1A 1

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

ITERATION	MEAN ATOMIC NUMBER	MEAN ATOMIC WEIGHT	H (1.2*MAW/MAN**2)
1	18.08401	38.43820	0.141044

ELEMENT	SIGMA	X	F(X)	PSF(X)/F(X)	WT ATOM	WT (O)	(ST DEV/AVE)*D
MG	5.25345E 03	6.27664E 03	3.96999E-01	0.99841	4.0875	6.7774	1.37829E-01
CR	6.61476E 03	1.44820E 02	9.75936E-01	1.00071	23.3490	34.1258	4.89963E-01
FE	7.28876E 03	2.49391E 02	9.62845E-01	0.99857	30.8031	39.6277	2.72368E-01
AL	5.28635E 03	4.19394E 03	5.07816E-01	0.99676	8.0870	16.6405	3.22736E-01
TI	6.15313E 03	2.30587E 02	9.59436E-01	1.00168	0.5976	0.8970	5.97930E-02
MN	6.91880E 03	1.15862E 02	9.81499E-01	0.99991	0.3231	0.4172	8.53480E-02
V	6.36268E 03	1.78494E 02	9.69352E-01	1.00043	0.1923	0.2830	1.37495E-02
NI	8.31116E 03	3.29496E 02	9.57178E-01	0.99996	0.1617	0.2058	2.10621E-02
					68.3213	98.9745	

ITERATION	MEAN ATOMIC NUMBER	MEAN ATOMIC WEIGHT	H (1.2*MAW/MAN**2)
2	18.07722	38.42336	0.141095

ELEMENT	SIGMA	X	F(X)	PSF(X)/F(X)	WT ATOM	WT (O)	(ST DEV/AVE)*D
MG	5.25345E 03	6.27572E 03	3.97022E-01	0.99836	4.0810	6.7666	1.37611E-01
CR	6.61476E 03	1.44732E 02	9.75950E-01	1.00070	23.3456	34.1501	4.90312E-01
FE	7.28876E 03	2.49447E 02	9.62836E-01	0.99858	30.7592	39.5712	2.71970E-01
AL	5.28635E 03	4.19291E 03	5.07867E-01	0.99666	8.7785	16.5866	3.21690E-01
TI	6.15313E 03	2.30427E 02	9.59462E-01	1.00165	0.5986	0.8985	5.98932E-02
MN	6.91880E 03	1.15793E 02	9.81510E-01	0.99990	0.3231	0.4172	8.53404E-02
V	6.36268E 03	1.78370E 02	9.69372E-01	1.00041	0.1924	0.2831	1.37554E-02
NI	8.31116E 03	3.29298E 02	9.57200E-01	0.99993	0.1617	0.2058	2.10612E-02
					68.2601	98.8792	

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION SAMPLE 55G 1A 2

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

ITERATION	MEAN ATOMIC NUMBER	MEAN ATOMIC WEIGHT	M (1.2*MAW/MAN**2)
1	18.10507	38.48788	0.140898

ELEMENT	SIGMA	X	F(X)	PSF(X)/F(X)	WT ATOM	WT (O)	(ST DEV/AVE)*D
MG	5.25345E 03	6.24345E 03	3.98463E-01	0.99475	4.1925	6.9516	2.33804E-01
CR	6.61476E 03	1.45975E 02	9.75750E-01	1.00090	24.1995	35.3690	3.41575E-01
FE	7.28876E 03	2.55424E 02	9.61981E-01	0.99947	30.2099	38.8646	3.97026E-01
AL	5.28635E 03	4.18022E 03	5.08741E-01	0.99495	9.2900	17.5532	1.97035E-01
TI	6.15313E 03	2.31746E 02	9.59244E-01	1.00188	0.6511	0.9773	1.87230E-02
MN	6.91880E 03	1.16257E 02	9.81439E-01	0.99997	0.2168	0.2799	1.02634E-01
V	6.36268E 03	1.79389E 02	9.69206E-01	1.00058	0.1240	0.1824	1.47301E-02
NI	8.31116E 03	3.29758E 02	9.57149E-01	0.99999	0.0829	0.1054	4.93258E-03
					68.9667	100.2834	

ITERATION	MEAN ATOMIC NUMBER	MEAN ATOMIC WEIGHT	M (1.2*MAW/MAN**2)
2	18.10265	38.48280	0.140917

ELEMENT	SIGMA	X	F(X)	PSF(X)/F(X)	WT ATOM	WT (O)	(ST DEV/AVE)*D
MG	5.25345E 03	6.24542E 03	3.98372E-01	0.99497	4.1705	6.9151	2.32576E-01
CR	6.61476E 03	1.45873E 02	9.75767E-01	1.00089	24.2214	35.4009	3.41883E-01
FE	7.28876E 03	2.55508E 02	9.61968E-01	0.99949	30.1940	38.8441	3.96816E-01
AL	5.28635E 03	4.18000E 03	5.08750E-01	0.99493	9.2431	17.4645	1.96039E-01
TI	6.15313E 03	2.31560E 02	9.59274E-01	1.00184	0.6523	0.9792	1.87581E-02
MN	6.91880E 03	1.16178E 02	9.81451E-01	0.99996	0.2168	0.2799	1.02631E-01
V	6.36268E 03	1.79246E 02	9.69230E-01	1.00055	0.1240	0.1825	1.47306E-02
NI	8.31116E 03	3.29727E 02	9.57152E-01	0.99998	0.0828	0.1054	4.93252E-03
					68.9049	100.1715	

CHROMITES FROM THE STILLWATER COMPLEX 55G 1A JULY 20,1967
IDENTIFICATION SAMPLE 55G 1A 3

COUNTS PER SECOND CORRECTED FOR DEAD TIME AND DRIFT

ITERATION	MEAN ATOMIC NUMBER	MEAN ATOMIC WEIGHT	M (1.2*MAW/MAN**2)
1	18.09195	38.44246	0.140936

ELEMENT	SIGMA	X	F(X)	PSF(X)/F(X)	WT ATOM	WT (O)	(ST DEV/AVE)*D
MG	5.25345E 03	6.33398E 03	3.94605E-01	1.00447	3.1261	5.1834	1.43467E-01
CR	6.61476E 03	1.46007E 02	9.75744E-01	1.00091	20.6241	30.1433	1.32179E 00
FE	7.28876E 03	2.31553E 02	9.65422E-01	0.99591	33.4580	43.0432	4.64782E-01
AL	5.28635E 03	4.16682E 03	5.09597E-01	0.99327	9.4564	17.8675	1.64419E-01
TI	6.15313E 03	2.31810E 02	9.59230E-01	1.00189	0.6495	0.9750	2.38658E-02
MN	6.91880E 03	1.16468E 02	9.81405E-01	1.00001	0.1638	0.2115	1.00100E-02
V	6.36268E 03	1.79443E 02	9.69195E-01	1.00059	0.1482	0.2180	1.55458E-03
NI	8.31116E 03	3.31237E 02	9.56962E-01	1.00018	0.1540	0.1960	5.72184E-02
					67.7801	97.8378	

ITERATION	MEAN ATOMIC NUMBER	MEAN ATOMIC WEIGHT	M (1.2*MAW/MAN**2)
2	18.06789	38.38928	0.141116

ELEMENT	SIGMA	X	F(X)	PSF(X)/F(X)	WT ATOM	WT (O)	(ST DEV/AVE)*D
MG	5.25345E 03	6.32802E 03	3.94799E-01	1.00398	3.1401	5.2065	1.44109E-01
CR	6.61476E 03	1.45776E 02	9.75779E-01	1.00087	20.6428	30.1706	1.32299E 00
FE	7.28876E 03	2.31534E 02	9.65420E-01	0.99591	33.3211	42.8671	4.62880E-01
AL	5.28635E 03	4.16393E 03	5.09733E-01	0.99301	9.3928	17.7473	1.63313E-01
TI	6.15313E 03	2.31415E 02	9.59293E-01	1.00182	0.6508	0.9768	2.39108E-02
MN	6.91880E 03	1.16286E 02	9.81432E-01	0.99998	0.1638	0.2115	1.00100F-02
V	6.36268E 03	1.79136E 02	9.69243E-01	1.00054	0.1483	0.2181	1.55950E-03
NI	8.31116E 03	3.30492E 02	9.57051E-01	1.00009	0.1541	0.1960	5.72287E-02
					67.6137	97.5941	