CHEMICAL CLASSIFICATION OF ROCKS BY DATA PROCESSING

OF 30

DAVID V. LEMONE

OF 30

New Mexico State Bureau of Mines and Mineral Resources

Open-file Report

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with 9 volumes of computer print-out sheets
and 2 boxes of input cards

CHEMICAL CLASSIFICATION OF ROCKS BY DATA PROCESSING

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The University of Texas at El Paso

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Numerically Indexed Artifical Johannsen Classification

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ABSTRACT

Chemical Classification of Rocks by Data Processing

Computer calculation and classification of more than 1800 oxide analyses of igneous rocks has been completed to determine individual weight and volume percentages, color indices, differentiation indices, and artificial Johannsen system classification notation. The two programs developed for this problem are based on data from the eleven standard oxides of whole-rock analyses. The programs are:

ROCKDATA

C. I. P. W. calculation which determines weight percent of normative minerals. Calculations for percent and type of olivine and plagioclase feldspar, color index, and differentiation index.

Conversion of 1. to 100 percent.

Conversion of 2. to volumetric percent by dividing by the specific gravity and adjustment of data to 100 percent.

Recombination of the data of 3. and adaption to an artificial Johannsen classification. Steps 1-4 will result in a four page data printout.

ROCKPLOT

Printout of ROCKDATA is suppressed. Calculated differentiation and color indices may be plotted against each other as well as silica percentage by means of a Calcomp plotter. This program utilizes data produced by ROCKDATA. Program prints summary of color index. differentiation index, and percent silica for each plot as a datacheck.

INTRODUCTION

This study of the chemical classification of rocks has developed from the author's introduction to programming and Control Data Corporation 3100 computer during 1969. The problem of chemical classification was chosen as the result of the memory of his earlier difficulties in petrography as an undergraduate.

There is nothing particularly new or unique about the presentation of this material in the application of computers to chemical classification systems in petrography. Johnson (1962, p. 143-155) has developed flow charts and successfully tested them on an I. B. M. 650 system at the University of Oklahoma Computer Laboratory nearly ten years ago. The hardware, software, and peripheral equipment is evolving and in a constant state of flux. This system, with some of its peculiar capabilities, is present with the hope that it might prove to be useful to petrographers and mineral industry personnel working in this discipline.

Card decks of this program are available on application from either the Director of the New Mexico State Bureau of Mines and Mineral Resources, Campus Station, Socorro, New Mexico, 87801 or the Director of the Computation Center, University of Texas at El Paso, El Paso Texas. 79968. Specific inquiries may be directed to the author at Post Office Box 3, University of Texas at El Paso, El Paso, Texas 79968.

The program has been developed at the University of Texas at El Paso Computation Center on a system consisting of:

Control Data Corporation

1) 32K CDC 3100

2) 415 punch

3) 405 card reader

4) 505 printer

5) 604 tape drive (3) (only one required)

6) 854 disc storage (2) (only one required)

Calcomp

1) 566 plotter

The programs have been written in FORTRAN IV.

This study was supported in part by the New Mexico State Bureau of Mines and Mineral Resources, University of Texas at El Paso Research Institute (Grant 083-50-79408) and the University of Texas at El Paso Computation Center (UGE00002). The writer gratefully acknowledges the assistance of Marshall Adams of the University of Texas at El Paso Computation Center and Jacques Renault of the New Mexico State Bureau of Mines.

DEFINITION OF PROBLEM

The objective is to develop a numerical classification scheme for rocks based on the standard oxide chemical analysis. This is to be done in a classical method utilizing the C. I. P. W. system (Cross, Iddings, Pirsson, and Washington) and the Johannsen classification scheme

(Johannsen, p. 83-102 and 141-162).

INPUT (figure 1)

The program requires the data from the eleven standard oxides of whole-rock analyses. They are SiO_2, TiO_2, Al_2O_3, Fe_2O_3, FeO, MgO MnO, CaO, Na_2O, K_2O, and P_2O_5. Data is placed on two cards in the above set sequence. Space is provided for three additional data points for a modified system on card two. An alphanumeric card is the third card. Cards must always be read in the specific three card sequence illustrated on figure 1. The writer suggests that column 80 on the three cards be reserved for 1, 2, and 3. The program in its present form must be modified to accept these numbers. This number combined with the 5-place unique alphanumeric sample number would then enable simplified sorting on tape and allow specific oxide analysis calls to be made with ease. The writer also suggests that a standard rock type designation be made to fit a ten digit field (columns 10-19, card 3) in order to code data for ease of sorting. This would allow tapes to be searched for a particular rock type on a standard name basis (e. g. basalt, gabbro, granite, etc.).

PROGRAM ROCKDATA (See Appendix 1, figure 2, and table 3)

This program converts the eleven standard oxides to 27 normative minerals based on a weight percent system as developed in the C. I. P. W. System. The basic C. I. P. W. calculation was converted from a Pennsylvania State University I. B. M. program developed by Charles W. Ondrick and John Holloway (1967) to the CDC system in 1969.

A print out format system for the C. I. P. W. was developed next (Appendix 5 page 1). The results from this data are recalculated from the first C. I. P. W. to 100 percent and result in the C. I. P. W. + FUDGE (Appendix 5, page 2). Several additional determinations are made by the system at this point; they are:

1) Determination of the precise normative plagioclase feldspar in the albite--anorthite isomorphous series if plagioclase is present

    prints: A) percent

    B) mineral name (6 in the series)

2) Determination of the precise normative olivine in the forsterite--fayalite isomorphous series if olivine is present

    prints: A) percent

    B) mineral name (6 in the series)

3) Determination and print statement for differentiation index or (DIFINX) as developed by Thorton and Tuttle (1960). It is the weight percent (normative C. I. P. W.) sum of:

    quartz

    orthoclase

    albite

    nepheline

    leucite

    kaliophilite (kalsilite)

The rocks being studied can be numerically indexed by differentiation index as illustrated by the partial classification study made of the rock types calculated here (see Volumes VII-IX).

4) Determination of color index (COLINX) It is the weight percent (normative C. I. P. W) sum of:

hypersthene
olivine
magnetite
ilmenite
apatite
diopside

This value could be used for classification in the same manner as DIFINX. The COLINX data should be derived from the volume percent calculation (Appendix 5, page 3).

The first part of the system has been tested. Data was supplied from Dr. R. Dennison of Mobil Research Laboratories (Table 1) from nine undesignated igneous rocks that he had calculated. The C. I. P. W. part of ROCKDATA was then tested (Volume I, Appendix 5). A tabular comparison of the two calculations shows two discrepancies (Table 2); they are found in the albite of sample 3XX which is probably a typing error of ten percent and in sample 7XX which has virtually no agreement and represents another typing error or test.

The next step is the conversion to an artificial Johannsen system. This is accomplished by conversion of all weight percents to volume percents by dividing by specific gravity and then converting these results to 100 percent COLINX, DEFINX, olivine type, and plagioclase feldspar are also calculated (Appendix 5, page 2).

The Johannsen system which is classified on the basis of class, order and family is then printed out in summary form as the last analysis (Pl. 4, fig. 4). The basis of this artificial system is as follows:

Class (1-4) designation based on volume percent of light and dark minerals--

light minerals (leucocrates)

Class 1	100-95
Class 2	95-50
Class 3	50-5
Class 4	5-0

dark minerals melanocrates(?) (melocrates) in reverse order

Order

A) (1-4) (first three classes) divided by albite-anorthite content of plagioclase feldspar.

No plagioclase or

If albite (100-90) order 1
albite (90-50) order 2
albite (50-10) order 3
albite (10-0) order 4

Orders are split into 26 families (0-25)

Based on a percentage split of 1) Quartz and felspathoids
2) Orthoclase to plagioclase felspar

B) Orders (1-4)

Class 4

If percent of ore to melocrates (undefinable by standard references)

GE. 95	class 4
95-50	class 3
50-5	class 2
5-0	class 1

Families

(0-12) (13 total)

	CENTER	FAMILY
Olivine	.GE. 95%	0
Olivine	95-50	1-4
Olivine	50-5	5-8
Olivine	.LE. 5	9-12

(Percent of olivine to percent of melocrates minus ore)

Families are lumped in class 4 because it is not possible to split biotite, amphibole, and pyroxene.

ROCKDATA therefore results in a four-page printout (see Appendix 5, p. 1-4)

1) C.I.P.W.
2) C.I.P.W. + FUDGE (C.I.P.W. calculated to 100 percent)
3) Volume percent
4) Artificial Johannsen system

Some 1869 rock analyses have been processed (Volume I, appendices 6 and 7). The result is a large sequence of sheets which can be filed by class, order, and family (Volumes II-VI)

by class 422 class 1
1276 class 2
154 class 3
17 class 4

In class 2--546 have a 2207 designation (Volume IV)

class II
order II
family 7
(equivalent to 29.2 percent of the total)

This designation (2207) should be subdivided as Johannsen did with his families 6, 7, 10, and 11
Separation of the four printout sheets makes an excellent and easily accessible reference set.

PROGRAM ROCKPLOT (See appendix 2 and figures 3, 4, 5 and 6)

This program utilizes the data generated by program ROCKDATA. Print statements have been suppressed as comment cards. A subprogram SUBPLOT has been added to the system.

One problem encountered in a program of this type is dimension on the plotter. (Please note comment 5 on figure 3). The Calcomp plotter takes the parameters listed here, adds .5 inch, and then truncates.

Divisions on the X and Y axis are spaced at one inch each, therefore, the division will be listed as 11.1 percent. If, instead 9.5 or 9.8 were utilized, the plot would be divided on a basis of 10 percent because as the .5 inch is added and then truncated to nearest whole number the result would be 10. The detail may be adjusted by changing the values of O and Q in figure 3 (See figures 5 and 6).

Program ROCKPLOT which utilizes disk storage is run on foreground and the plot is run on background. By manipulating the program one can easily convert from the program mode of differentiation index vs. weight percent silica to color index vs. differentiation index or color index vs. weight percent silica. The program also prints out the data (COLINX, DIFINX, SI02) on each plot as well as its alphanumeric notation.

The end result of ROCKPLOT is a two-dimensional scatter diagram displaying any two variables (figures 4, 5 and 6). It is then possible to divide rock types into easily discernible fields which may reflect differences in genesis and alteration.

CONCLUSIONS

The utilization of this program is in its speed of calculation, ROCKDATA print out, and its easily readable ROCKPLOT charts. A number of applications can be reasonably ascertained from these results; they are:

1) Genesis of rocks

Igneous rocks of similar designation may be visually separated by

ROCKPLOT into broad fields (e.g. oceanic and plateau basalts).

2) Recognition of ore deposits and alteration effects

The origin of an ore deposit because of its peculiar chemical environment and accompanying alteration effects must by its very nature effect the host rock. Therefore, in a given plot of an igneous rock type ore deposits and altered rocks should plot outside the normal graphic position.

3) Metasedimentary and metaigneous rocks

The chemical composition of these rocks differ significantly from each other and from igneous rocks that they may resemble. These types separate out nicely in the artificial Johannsen system and less clearly on the plots (see Volume II-VI).

4) Literature search

Rock data that coincides in position on plots, despite being widely separated geographically, may indicate similar environments of formation (e.g. a basalt from Siberia and from New Mexico). It is possible that no comparison really exists; however, it enables a rapid check of references which listed with the ROCKPLOT.

5) Classification of aphanitic igneous rocks

Preliminary examination of the results of chemical classification indicate that the system should be very useful in this area. Petrographically determined latite has a great variability in composition ranging from essentially a rhyolite to virtually a basalt as an example.

6) Other Parameters

The program may be revised to include the calculations for such items as crystallization index (Poldervaart and Parker, 1964) and solidification index (Kuno, 1968) which then can be plotted for visual examination. The produced data, with conversion, could be statistically tested for factor analysis, etc.

Despite the rapidity and ease in which the calculations for the chemical classification designates can be made and the visual determination from plots that can be utilized in this type of system, it cannot replace the hand specimen and thin-section analysis made by the petrographer. It should also always be remembered that the computer can neither judge the quality of a chemical analyst nor the accuracy of the data it manipulates. The data produced by this system should, hopefully, be a meaningful adjunct to the worker.

REFERENCES

Johannsen, Albert, 1931, A descriptive petrography of the igneous rocks, Univ. Chicago Press, v. I, Introduction, textures, classifications and glossary: 319 p.

Johnson, Kenneth S., 1962, CIPW flow chart: Oklahoma Geology Notes, v. 22, p. 143-155.

Kuno, Hisashi, 1968, Differentiation of basalt magmas, in Basalts, Hess, H. H., and Poldervaart, A., eds., John Wiley and Sons Interscience Publishers, New York, p. 624-688.

Ondrick, Charles W. and Holloway, John, 1967, CIPW norm for I. B. M.: Penn. State Univ., Mineral Industries Exp. Sta., Contribution in Computer Science, 67 ser.

Poldervaart, A. and Parker, Alfred B., March 1964, Crystallization index and normative analysis: Amer. Jour. Science, v. 262, p. 281-289.

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IBM INTERNATIONAL BUSINESS MACHINES CORPORATION Form X24-6599-0
Printed in U. S. A.

MULTIPLE-CARD LAYOUT FORM

Company: INPUT FORMAT FOR DATA
Application: ROCKDATA AND ROCKPLOT PROGRAMS
by ______ Date ______ Job No. ______ Sheet No. ______

THREE DIGIT NUMERIC CODE	TWO LETTER ALPHABETIC CODE	SiO_2 (SIO2)	TiO_2 (TIO2)	Al_2O_3 (AL2O3)	Fe_2O_3 (FE2O3)	FeO (FEO)	MnO (XMNO)	MgO (XMGO)	
		CaO (CAO)	Na O (XNA2O)	K O (XK2O)	P O. (P2O5)	OTHER DATA	OTHER DATA	OTHER DATA	

THREE DIGIT NUMERIC CODE	TWO LETTER ALPHABETIC CODE	BLANK	ALPHANUMERIC SAMPLE LABEL

Figure 1 -- Data input.

A-$^{7}_{9}$ JOB CARD
B-$^{7}_{9}$ FORTRAN,L,X
C-PROGRAM ROCK DATA
D-FINIS (COL.10)
E-$^{7}_{9}$ LOAD,56
F-$^{7}_{9}$ RUN,10,NM
G-DATA DECK (SEE PLATE 1)
H-999 EF
I-BLANK CARD
J-$^{77}_{88}$ (END OF JOB)

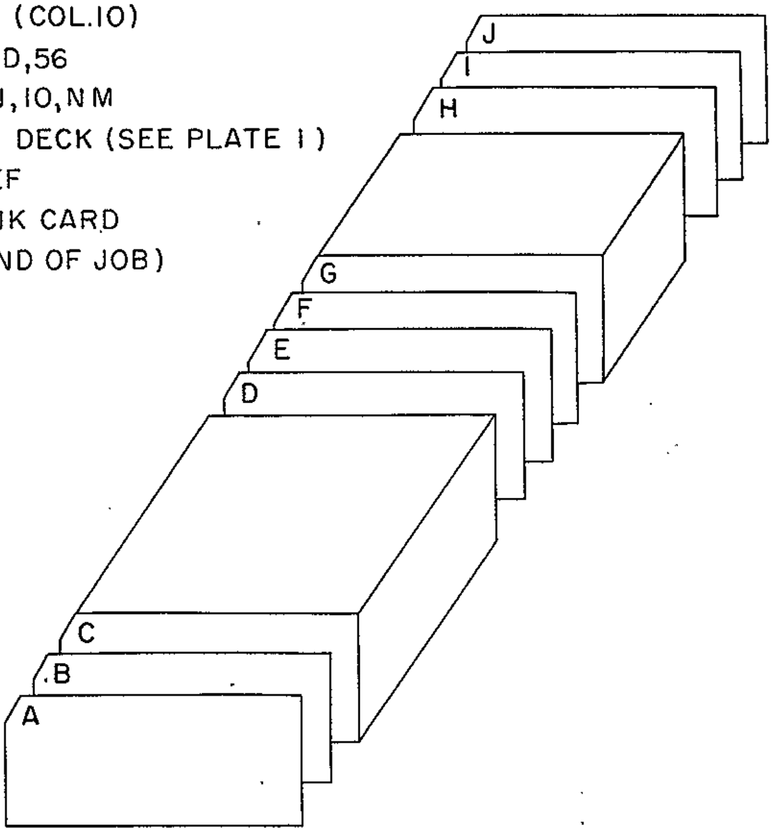


Figure 2 -- Program Rockdata.

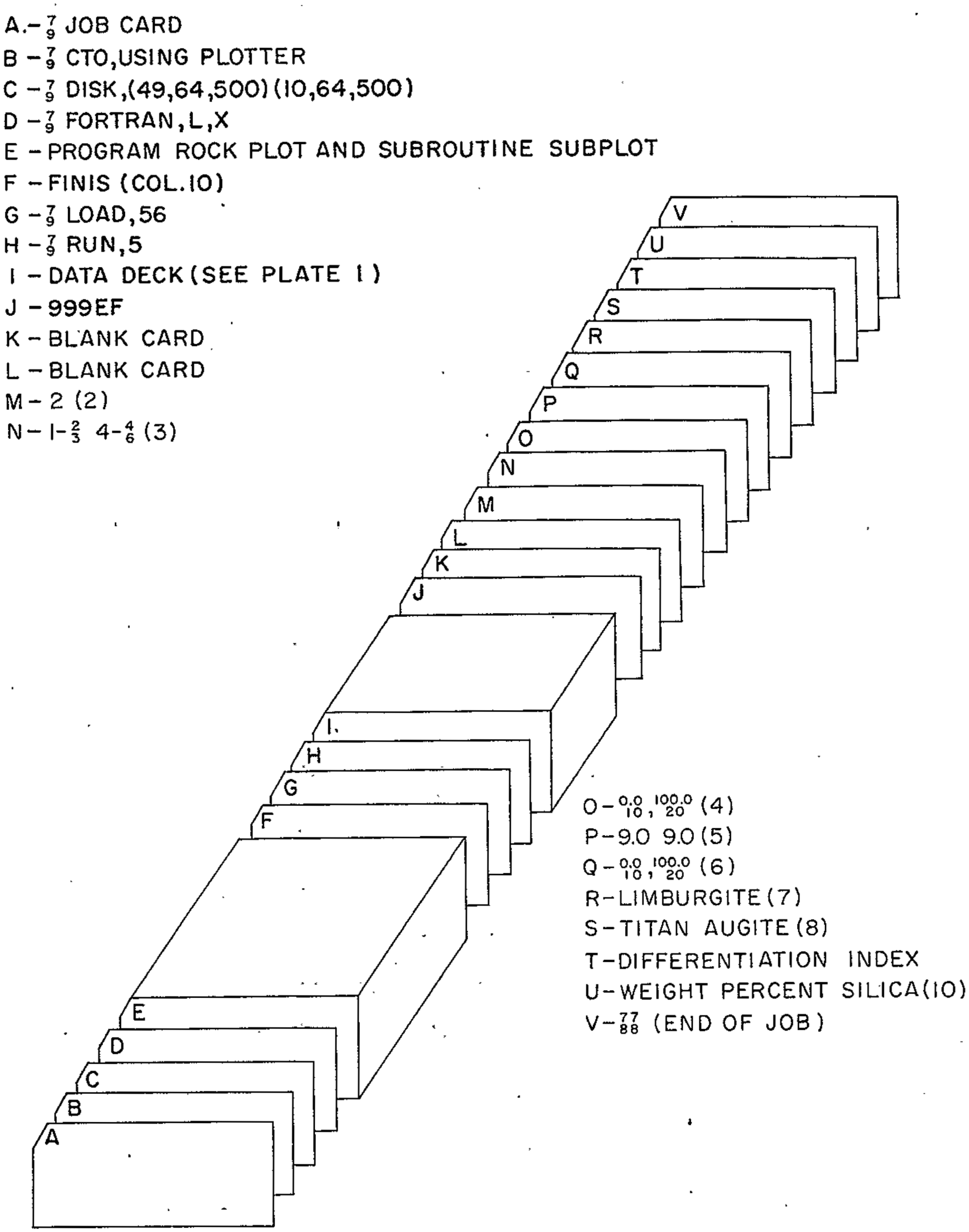
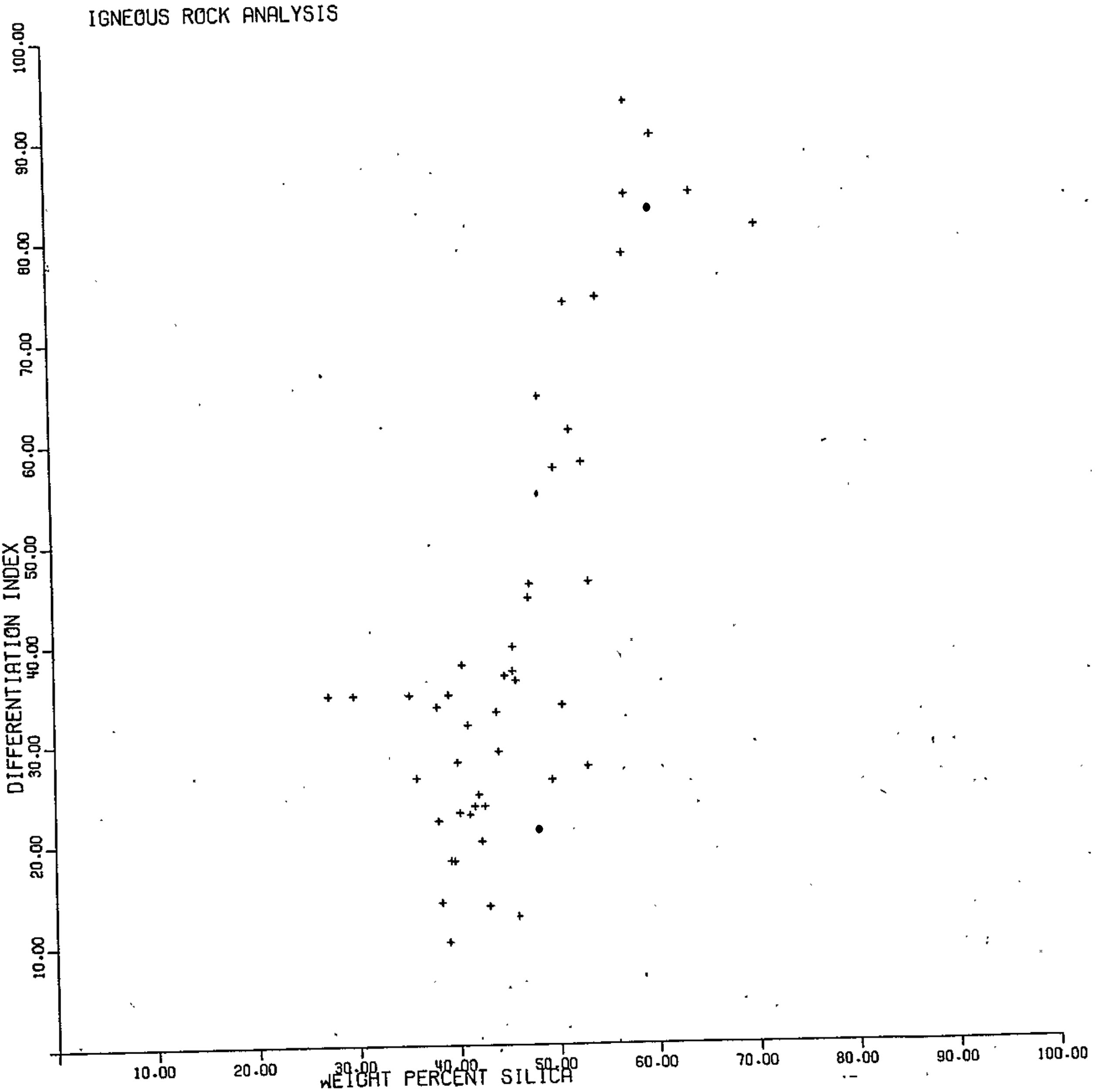


Figure 3 -- Program Rockplot.

2c Le Mone

FIG. 4



3151 UGE00002

Fig. 5

Le Maitre

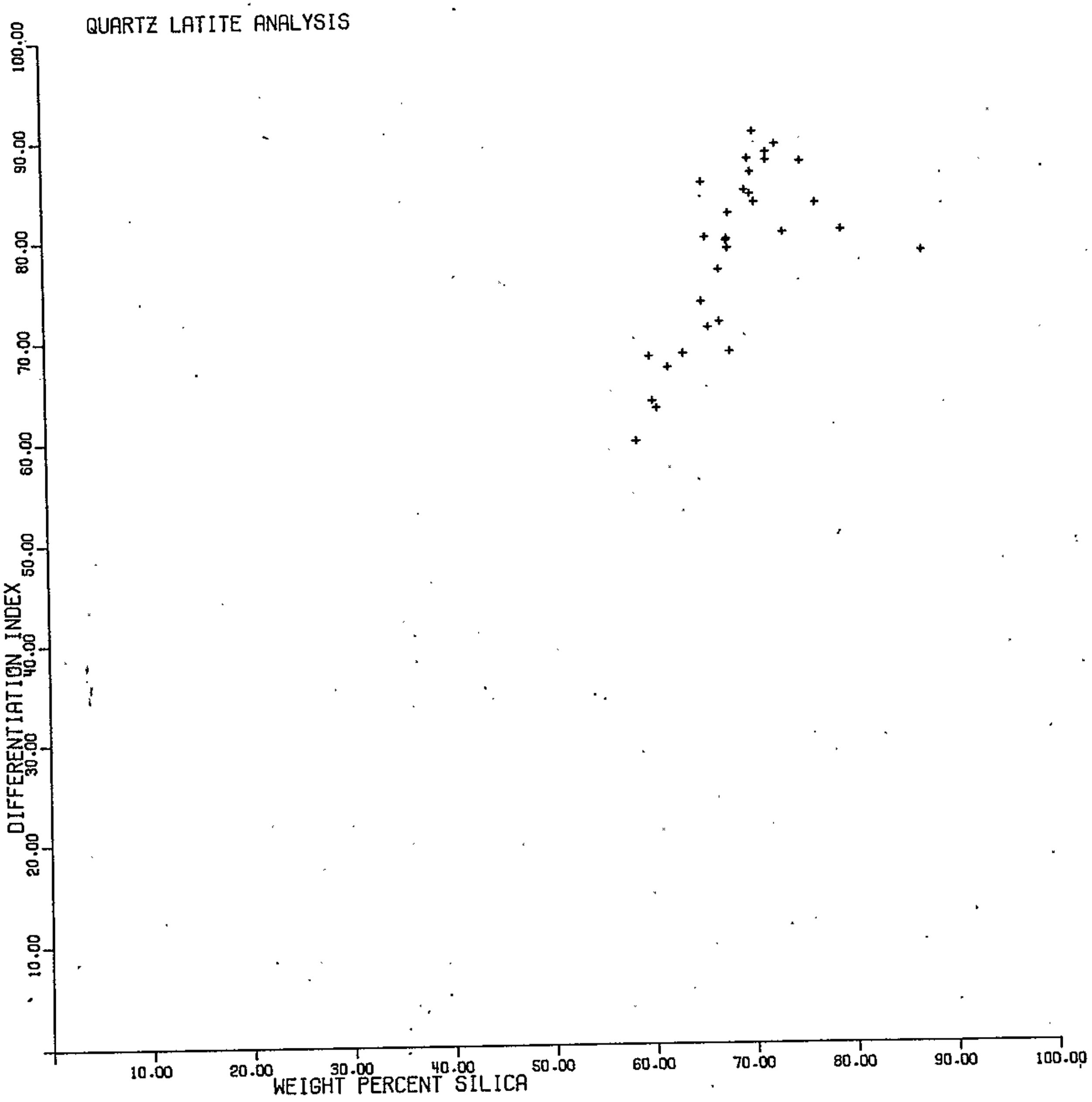


FIG. 6

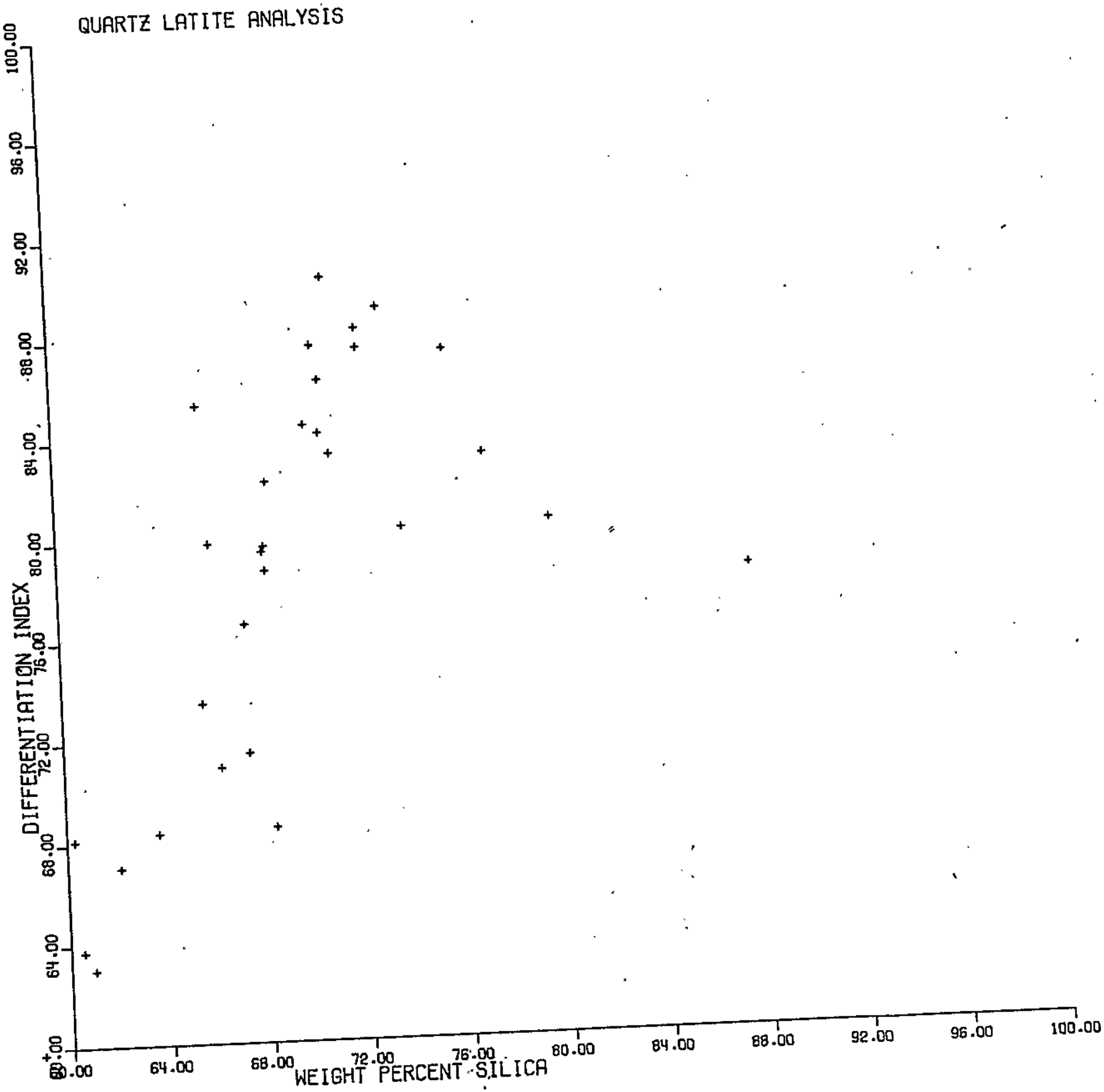

QUARTZ LATITE ANALYSIS
DIFFERENTIATION INDEX
100.00
96.00
92.00
88.00
84.00
80.00
76.00
72.00
68.00
64.00
60.00
60.00
64.00
68.00
72.00
76.00
80.00
84.00
88.00
92.00
96.00
100.00
WEIGHT PERCENT SILICA

Table 1 -- Mobil Research Oxide Analyses

(courtesy R. Dennison for system test)

	1XX	3XX	4XX	5XX	6XX	7XX	11XX	13XX	14XX
SiO_2	54.77%	61.61%	57.75%	56.45%	52.23%	61.03%	52.89%	67.66%	58.90%
TiO_2	1.02	0.57	0.95	0.61	0.65	0.90	1.32	0.48	0.88
Al_2O_3	17.71	19.37	18.99	20.43	23.37	17.03	18.46	16.45	17.07
Fe_2O_3	4.80	1.12	2.10	2.70	0.90	4.57	4.27	1.80	1.95
FeO	3.64	0.88	1.89	1.35	2.56	1.69	3.17	1.08	3.24
MnO	0.21	0.09	0.16	0.21	0.24	0.16	0.19	0.08	0.15
MgO	2.40	0.65	2.12	0.44	1.40	1.20	3.23	0.28	2.03
CaO	8.11	5.63	9.26	4.90	7.42	5.82	9.08	3.34	5.29
Na_2O	4.00	4.61	5.10	6.25	4.61	4.23	4.43	4.50	4.79
K_2O	1.92	4.79	1.56	4.03	4.57	2.65	2.77	4.15	3.00
P_2O_5	0.06	0.00	0.08	0.00	0.03	0.05	0.01	0.00	0.01
SO_3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO_2	0.30	0.13	0.00	0.28	0.00	0.00	0.00	0.10	0.22
H_2O+	1.15	0.60	0.39	2.02	1.45	0.55	0.33	0.31	2.62
H_2O-	0.21	0.00	0.18	0.37	0.27	0.29	0.09	0.03	0.05
Total	100.30	100.05	100.03	100.04	99.70	100.17	100.24	100.26	100.20

TABLE 2 -- Comparison of ROCKDATA and Mobil Calculations

	ROCKDATA	Mobil Calculation
Sample 1XX		
Apatite	.139	---
Ilmenite	1.937	1.94
Orthoclase	11.347	11.34
Albite	33.847	33.83
Anorthite	24.700	24.10
Magnetite	6.960	6.96
Quartz	5.988	6.00
Total Diopside	12.055	12.06
with the composition		
Diopside (WO)	6.324	
Diopside (EN)	4.627	
Diopside (FS)	1.103	
Total Hypersthene	1.672	1.66
with the composition		
Enstatite	1.350	
Ferrosillite	.322	
Sample 3XX		
Ilmenite	1.083	1.08
Orthoclase	28.308	28.3
Albite	39.009	28.30
Anorthite	18.015	18.02
Magnetite	1.478	1.48
Hematite	.101	.10
Quartz	5.569	5.6
Total Diopside	3.491	3.49
Wollastonite	2.268	2.26
Sample 4XX		
Apatite	.185	---
Ilmenite	1.804	1.80
Orthoclase	9.219	9.22
Albite	43.155	43.13
Anorthite	24.318	24.32
Magnetite	3.045	3.05
Quartz	3.680	3.7
Total Diopside	12.261	12.26
Wollastonite	2.295	2.31

(Table 2, continued)

Sample 5XX		
Ilmenite	1.159	1.16
Orthoclase	23.816	23.81
Nepheline	5.492	5.35
Albite	42.748	42.98
Anorthite	15.791	15.80
Magnetite	3.268	3.27
Hematite	.446	.45
Total Diopside	2.363	2.36
Wollastonite	2.289	2.28
Sample 6XX		
Apatite	.070	---
Ilmenite	1.235	1.23
Orthoclase	27.008	27.00
Nelpheline	10.563	10.54
Albite	19.511	19.54
Anorthite	29.580	29.59
Magnetite	1.305	1.31
Total Olivine	2.900	2.90
Total Diopside	5.814	5.82
Sample 7XX		
Apatite	.116	---
Ilmenite	1.709	1.71
Orthoclase	15.661	15.66
Albite	35.794	21.41
Anorthite	19.656	---
Magnetite	3.360	.28
Hematite	2.252	---
Quartz	14.082	20.84
Total Diopside	6.446	9.75
Wollastonite	.256	6.93
Acmite	0	12.66
Sample 11XX		
Apatite	.023	---
Ilmenite	2.507	2.51
Orthoclase	16.370	16.37
Nepheline	3.517	3.49
Albite	30.993	31.03
Anorthite	22.306	22.31
Magnetite	6.191	6.19
Total Olivine	.154	.16
Total Diopside	17.761	17.75

(Table 2, continued)

Sample 13XX		
Ilmenite	.912	.91
Orthoclase	24.526	25.52
Albite	38.078	38.06
Anorthite	12.431	12.44
Magnetite	2.351	2.35
Hematite	.179	.18
Quartz	18.920	18.94
Total Diopside	1.504	1.50
Wollastonite	.922	.92
Sample 14XX		
Apatite	.023	---
Ilmenite	1.671	1.67
Orthoclase	17.729	17.72
Albite	40.532	40.51
Anorthite	16.218	16.22
Magnetite	2.827	2.83
Quartz	5.932	5.96
Total Diopside	8.119	8.11
Total Hypersthene	4.260	4.26

```
                                  31/32/3300 FORTRAN (3.1)/MSOS   06/09/70
      PROGRAM ROCKDATA
      INTEGER A,B,ZNAME,CONAME
C
C     ORIGINAL CIPW CALCULATION PROGRAMMED FOR IBM MACHINE PENN. STATE UT
C     BY CHARLES W. ONDRICK AND JOHN HOLLOWAY (1967)
C     MODIFIED TO CDC 3100 B BY DAVID V. LE MONE AND MARSHALL W. ADAMS
C     UNIVERSITY TEXAS EL PASO (1969)
C     PHASE 1, CIPW RECALCULATED TO 100 PERCENT (+ FUDGE)
C     LE MONE AND ADAMS, UNIV. TEXAS EL PASO (1969)
C     PHASE 2, PLAGIOCLASE CALCULATION, UTEP, LE MONE AND ADAMS (1969)
C     PHASE 3, OLIVINE CALCULATION, UTEP, LE MONE (1969)
C     PHASE 4, CIPW CALCULATION TO VOLUME PERCENT CONVERSION
C     UNIV. TEXAS EL PASO, LEMONE (1969)
C     PHASE 5, ARTIFICIAL JOHANNSEN CLASSIFICATION COMPUTATION
C     UNIV. TEXAS EL PASO, LEMONE (1969)
C     PHASE 6, DIFFERENTIATION INDEX CALCULATION (DIFINX)
C     UNIV. TEXAS EL PASO, LEMONE (1969)
C     PHASE 7, COLOR INDEX CALCULATION (COLINX)
C     UNIV. TEXAS EL PASO, LEMONE (1969)
C     PHASE 8, SUBROUTINE SUBPLOT, MULTIPLE AND SINGLE
C     UNIV. TEXAS EL PASO, LEMONE (1969)
C
C
C     GLOSSARY OF PROGRAM TERMS
C     NAME=PLAGIOCLASE FELDSPAR MINERAL NAME
C     ARRAY=ALPHANUMERIC LABEL
C     NAMEOL=OLIVINE MINERAL NAME
C     MNAME=JOHANNSEN FAMILY FOR CLASSES 1 TO 3 (ARTIFICIAL SYSTEM)
C     ZNAME=JOHANNSEN FAMILIES FOR CLASS 4 (ARTIFICIAL SYSTEM)
C     CONAME=JOHANNSEN CLASS AND ORDER
C     PCNTAB=PERCENTAGE OF ALBITE IN PLAGIOCLASE FELDSPAR
C     PCNTAN=PERCENTAGE OF ANORTHITE IN PLAGIOCLASE FELDSPAR
C     PCNTFO=PERCENTAGE OF FORSTERITE IN OLIVINE
C     PCNTFA=PERCENTAGE OF FAYALITE IN OLIVINE
C     DIFINX=DIFFERENTIATION INDEX
C     COLINX=COLOR INDEX
C     TOTQUAR=TOTAL QUARFELOIDS
C     TOTPYAM=TOTAL PYRIBOLES
C     TOTORE=TOTAL ORE
C     TOTAUX=TOTAL AUXILIARY CONSTITUENTS (CORUNDUM + APATITE)
C     TOTLEC=TOTAL LEUCOCRATES (TOTQUAR + TOTAUX)
C     TOTMEL=TOTAL MELOCRATES  (TOTPYAM + TOTOLV + TOTORE)
C     FOIDS=TOTAL FELSPATHOIDS
C
C
      DIMENSION NAME (5), ARRAY (10), NAMEOL (5),
     1MNAME (5), ZNAME (7), CONAME (5)
      REAL KF,KFPLAG
   10 READ15    ,K,A,B,SI02,TI02,AL203,FE203,FE0,XMN0,XMG0,CA0,XNA20,XK2
     10,P205.OTHER
   15 FORMAT(I3,2A1,7F10.5/5X,7F10.5)
      READ 16, ARRAY
   16 FORMAT (10A8)
      SI02A=SI02
      TI02A=TI02
      AL203A=AL203
      FE203A=FE203
      FE0A=FE0
      XMN0A=XMN0
      XMG0A=XMG0
```

(Table 3, continued)

```
      CAOA=CAO
      XNA2OA=XNA2O
      XK2OA=XK2O
      P2O5A=P2O5
      LEMONE=1
      UTEP=1.0
      IF(K-999)20     ,380    ,380
   20 PRINT25     ,K,A,B
   25 FORMAT(1H1,6(/),49X,6HSAMPLE,I3,2A1)
      IF(SIO2)30     ,30     ,40
   30 PRINT 17, ARRAY
   17 FORMAT (/,35X,10A8)
      PRINT 35
   35 FORMAT(1H0,34X,30HTHIS SAMPLE CONTAINS NO SILICA)
      GO TO 375
   40 PRINT45
   45 FORMAT(1H0,34X,54HTHE CHEMICAL COMPOSITION OF THE ROCK IN WEIGHT P
     1ERCENT)
      PRINT50
   50 FORMAT(1H0,5X,4HSIO2,6X,4HTIO2,5X,5HAL2O3,5X,5HFE2O3,7X,3HFEO,7X,3
     1HMNO,7X,3HMGO,7X,3HCAO,6X,4HNA2O,7X,3HK2O,6X,4HP2O5,5X,5HOTHER)
      PRINT55     ,SIO2,TIO2,AL2O3,FE2O3,FEO,XMNO,XMGO,CAO,XNA2O,XK2O,P2O
     15,OTHER
   55 FORMAT(1H ,4X,11(F6.3,4X),F5.3)
      BSUM=(SIO2+TIO2+AL2O3+FE2O3+FEO+XMNO+XMGO+CAO+XNA2O+XK2O+P2O5)
      PRINT60     ,BSUM
   60 FORMAT(1H ,34X,3HSUM,23X,F7.3)
      PRINT65
   65 FORMAT(1H0,49X,31H    *     *     *     *     *     *      )
C             CALCULATION OF THE C.I.P.W. NORM
   70 AP=0.0
      XIL=0.0
      SP=0.0
      RU=0.0
      XKS=0.0
      XKP=0.0
      XLC=0.0
      OR=0.0
      XNS=0.0
      XNE=0.0
      AB=0.0
      AN=0.0
      C=0.0
      XMT=0.0
      HM=0.0
      Q=0.0
      OL=0.0
      FO=0.0
      FA=0.0
      CS=0.0
      DI=0.0
      WO=0.0
      EN=0.0
      FS=0.0
      HY=0.0
      XMO=0.0
      AC=0.0
C     MOLECULAR PROPORTIONS CALCULATED
      SIO2=SIO2/60.09
      TIO2=TIO2/79.90
      AL2O3=AL2O3/101.96
      FE2O3=FE2O3/159.70
```

(Table 3, continued)

```
      FEO=FEO/71.85
      XMNO=XMNO/70.94
      XMGO=XMGO/40.32
      CAO=CAO/56.08
      XNA2O=XNA2O/61.982
      XK2O=XK2O/94.20
      P2O5=P2O5/141.950
      PRINT75
   75 FORMAT(1H0,45X,21HMOLECULAR PROPORTIONS)
      PRINT80     ,SIO2,TIO2,AL2O3,FE2O3,FEO,XMNO,XMGO,CAO,XNA2O,XK2O,P2O
     15
   80 FORMAT(1H ,4X,11(F6.4,4X))
      FEO=FEO+XMNO
C     P2O5 TO APATITE
      AP=P2O5
      CAO=CAO-3.3  *P2O5
C     TIO2 TO ILMENITE, SPHENE, RUTILE
      IF(FEO-TIO2)90     ,85     ,85
   85 XIL=TIO2
      FEO=FEO-TIO2
      GO TO 105
   90 XIL=FEO
      TIO2=TIO2-FEO
      FEO=0.0
      IF(CAO-TIO2)100    ,95     ,95
   95 SP=TIO2
      CAO=CAO-TIO2
      GO TO 105
  100 SP=CAO
      TIO2=TIO2-CAO
      CAO=0,0
      RU=TIO2
C     K2O TO KALIOPHILITE AND POTASSIUM METASILICATE
  105 IF(AL2O3-XK2O)115    ,110    ,110
  110 XKP=XK2O
      AL2O3=AL2O3-XK2O
      GO TO 120
  115 XKP=AL2O3
      XK2O=XK2O-AL2O3
      AL2O3=0.0
      XKS=XK2O
C     NA2O  TO NEPHELINE, ACMITE, SODIUM METASILICATE
  120 IF(AL2O3-XNA2O)130    ,125    ,125
  125 XNE=XNA2O
      AL2O3=AL2O3-XNA2O
      GO TO 145
  130 XNE=AL2O3
      XNA2O=XNA2O-AL2O3
      AL2O3=0.0
      IF(FE2O3-XNA2O)140    ,135    ,135
  135 AC=XNA2O
      FE2O3=FE2O3-XNA2O
      GO TO 145
  140 AC=FE2O3
      XNA2O=XNA2O-FE2O3
      FE2O3=0.0
      XNS=XNA2O
C     AL2O3 TO ANORTHITE AND CORUNDUM
  145 IF(CAO-AL2O3)155    ,155    ,150
  150 AN=AL2O3
      CAO=CAO-AL2O3
      GO TO 160
```

(Table 3, continued)

```
  155 AN=CAO
      AL2O3=AL2O3-CAO
      CAO=0.0
      C=AL2O3
C     FE2O3 TO MAGNETITE, HEMATITE
  160 IF(FE2O3-FEO)165    ,165    ,170
  165 XMT=FE2O3
      FEO=FEO-FE2O3
      GO TO 175
  170 XMT=FEO
      FE2O3=FE2O3-FEO
      FEO=0.0
      HM=FE2O3
C     CAO, MGO, FEO TO OLIVINE, MONTICELLITE, CALCIUM ORTHOSILICATE
  175 XMGFE=XMGO+FEO
      RMGFE=XMGO/XMGFE
      IF(XMGFE-CAO)180    ,185    ,185
  180 XMO=XMGFE
      CAO=CAO-XMGFE
      CS=CAO
      GO TO 190
  185 XMO=CAO
      XMGFE=XMGFE-CAO
      OL=XMGFE
  190 SIO2=SIO2-SP-(2.0*XKP)-XKS-(2.0*XNE)-(4.0*AC)-XNS-(2.0*AN)-XMO-(CS
     1/2.0)-(OL/2.0)
      IF(SIO2)195    ,270    ,205
  195 PRINT200    ,SIO2
  200 FORMAT(1H0,29X,52HNOT ENOUNGH SIO2 TO FORM ALL UNDERSATURATED MINE
     1RALS 1X,7HSIO2 = ,F5.3)
C  CHECK PRINT CTRL. CHR.
      GO TO 375
  205 XXXKP=XKP*2.0
      IF(SIO2-XXXKP)210    ,210    ,215
  210 XLC=SIO2/2.0
      XKP=XKP-XLC
      GO TO 270
  215 XLC=XKP
      SIO2=SIO2-XXXKP
      XKP=0.0
      CCSS=CS/2.0
      IF(SIO2-CCSS)220    ,220    ,225
  220 WO=2.0 *SIO2
      CS=CS-WO
      GO TO 270
  225 WO=CS
      SIO2=SIO2-CCSS
      CS=0.0
      IF(SIO2-XMO)230    ,230    ,235
  230 DI=SIO2
      XMO=XMO-SIO2
      GO TO 270
  235 DI=XMO
      SIO2=SIO2-XMO
      XMO=0.0
      XXXLC=XLC*2.0
      IF(SIO2-XXXLC)240    ,240    ,245
  240 OR=SIO2/2.0
      XLC=XLC-OR
      GO TO 270
  245 OR=XLC
      SIO2=SIO2-XXXLC
```

(Table 3, continued)

```
      XLC=0.0
      XXXNE=XNE*4.0
      IF(SI02-XXXNE)250     ,250     ,255
  250 AB=SI02/4.0
      XNE=XNE-AB
      GO TO 270
  255 AB=XNE
      SI02=SI02-XXXNE
      XNE=0.0
      XXXOL=OL/2.0
      IF(SI02-XXXOL)260     ,260     ,265
  260 HY=SI02*2.0
      OL=OL-HY
      GO TO 270
  265 HY=OL
      SI02=SI02-XXXOL
      OL=0.0
      Q=SI02
C     CONVERSION TO WEIGHT PERCENT
  270 R=1.0 -RMGFE
      CS=CS+XMO
      XMOOL=XMO+OL
      FO=RMGFE*XMOOL
      FA=R*XMOOL
      EN=HY*RMGFE
      FS=HY*R
      DIWO=DI*1.0
      DIEN=DI*RMGFE
      DIFS=DI*R
      AP=AP*328.38
      RU=RU*79.90
      C=C*101.96
      Q=Q*60.09
      XKP=XKP*316.34
      XLC=XLC*436.52
      OR=OR*556.70
      CS=CS*86.125
      WO=WO*116.17
      XNE=XNE*284.122
      AB=AB*524.482
      FA=FA*101.895
      FO=FO*70.365
      EN=EN*100.41
      FS=FS*131.94
      HM=HM*159.70
      XMT=XMT*231.55
      AN=AN*278.22
      XKS=XKS*154.29
      XNS=XNS*122.07
      SP=SP*196.07
      XIL=XIL*151.75
      AC=AC*462.042
      DIWO=DIWO*116.17
      DIEN=DIEN*100.41
      DIFS=DIFS*131.94
      OL=FO+FA+CS
      DI=DIWO+DIEN+DIFS
      HY=EN+FS
      DIFINX=OR+AB+C+XNE+XKP+XLC
      COLINX=DI+HY+OL+XMT+XIL+AP
      ASUM=(AP+XIL+SP+RU+XKP+XKS+XNE+AC+XNS+AN+C+XMT+HM+FA+CS+FO+XLC+WO+
     1EN+OR+AB+FS+Q+DIWO+DIEN+DIFS)
```

(Table 3, continued)

```
      PRINT275
  275 FORMAT(1H0,29X,32HC.I.P.W. NORM(IN WEIGHT PERCENT))
  277 PRINT 280,     AP            ,DIFINX
  280 FORMAT(1H ,34X,7HAPATITE,19X,F7.3,20X,21HDIFFERENTIATION INDEX,10X
     1,F7.3)
      PRINT285    ,XIL          ,COLINX
  285 FORMAT(1H ,34X,8HILMENITE,18X,F7.3,20X,11HCOLOR INDEX.20X8F7.3)
      PRINT290    ,SP
  290 FORMAT(1H ,34X,6HSPHENE,20X,F7.3)
      PRINT295    ,RU
  295 FORMAT(1H ,34X,6HRUTILE,20X,F7.3)
      PRINT300    ,XKS
  300 FORMAT(1H,34X,14HK-METASILICATE,12X,F7.3)
      PRINT305    ,XKP
  305 FORMAT(1H ,34X,13HKALIOPHILLITE,13X,F7.3)
      PRINT310    ,XLC
  310 FORMAT(1H ,34X,7HLEUCITE,19X,F7.3)
      PRINT315    ,OR
  315 FORMAT(1H 34X,10HORTHOCLASE,16X,F7.3)
      PRINT320    ,XNS
  320 FORMAT(1H ,34X,15HNA-METASILICATE,11X,F7.3)
      PRINT325    ,XNE
      PABAN = AB/524.482 + AN/278.22
      IF (PABAN.GT.0.0)
     1PCNTAB = ((AB/524.482)/PABAN) * 100.
      IF (PABAN.GT.0.0)
     1PCNTAN = ((AN/278.22)/PABAN) * 100.
      IF(PCNTAB.GE.90.0)ENCODE(20,490,NAME)
      IF(PCNTAB.LT.90.0)ENCODE(20,480,NAME)
      IF(PCNTAB.LT.70.0)ENCODE(20,460,NAME)
      IF(PCNTAB.LT.50.0)ENCODE(20,440,NAME)
      IF(PCNTAB.LT.30.0)ENCODE(20,420,NAME)
      IF(PCNTAB.LT.10.0)ENCODE(20,410,NAME)
      PFOFA = FO/70.365 + FA/101.895
      IF (PFOFA.GT.0.0)
     1PCNTFO = ((FO/70.365)/PFOFA) * 100.
      IF (PFOFA.GT.0.0)
     1PCNTFA = ((FA/101.895)/PFOFA) * 100.
      IF (PCNTFO.GE.90.0) ENCODE (20,590,NAMEOL)
      IF (PCNTFO.LT.90.0) ENCODE (20,580,NAMEOL)
      IF (PCNTFO.LT.70.0) ENCODE (20,560,NAMEOL)
      IF (PCNTFO.LT.50.0) ENCODE (20,540,NAMEOL)
      IF (PCNTFO.LT.30.0) ENCODE (20,520,NAMEOL)
      IF (PCNTFO.LT.10.0) ENCODE (20,510,NAMEOL)
  325 FORMAT(1H ,34X,9HNEPHELINE,17X,F7.3)
      PRINT330    ,AB
  330 FORMAT(1H ,34X,6HALBITE,20X,F7.3)
      PRINT335    ,AN
  335 FORMAT(1H ,34X,9HANORTHITE,17X,F7.3)
      PRINT340    ,C
  340 FORMAT(1H ,34X,8HCORUNDUM,18X,F7.3)
      PRINT345    ,XMT
  345 FORMAT(1H ,34X,9HMAGNETITE,17X,F7.3)
      PRINT350    ,HM
  350 FORMAT(1H ,34X,8HHEMATITE,18X,F7.3)
      PRINT355    ,Q
  355 FORMAT(1H ,34X,6HQUARTZ,20X,F7.3)
      PRINT360    ,OL,FO,FA,CS
  360 FORMAT(1H ,34X,13HTOTAL OLIVINE,13X,F7.3,22H WITH THE COMPOSITION
     1,/40X,10HFORSTERITE,11X,F7.3/40X,8HFAYALITE,13X,F7.3/40X,16HCA-ORT
     2HOSILICATE,5X,F7.3)
      PRINT365    ,DI,DIWO,DIEN,DIFS,HY,EN,FS,WO,AC
```

(Table 3, continued)

```
365 FORMAT(1H ,34X,14HTOTAL DIOPSIDE,12X,F7.3,22H WITH THE COMPOSITION
   1,/40X,13HDIOPSIDE (WO),8X,F7.3/40X,13HDIOPSIDE (EN),8X,F7.3/40X,13
   2HDIOPSIDE (FS),8X,F7.3/35X,17HTOTAL HYPERSTHENE, 9X,F7.3,20HWITH T
   3HE COMPOSITION/40X,9HENSTATITE,12X,F7.3/40X,12HFERROSILLITE, 9X,F7
   4.3/35X,12HWOLLASTONITE,14X,F7.3/35X,6HACMITE,20X,F7.3)
    PRINT370    ,ASUM
370 FORMAT(1H ,34X,3HSUM,23X,F7.3)
    PRINT65
    IF (PABAN.GE.0.001)
   1PRINT 470, NAME, PCNTAB, PCNTAN
    IF (PFOFA.GE.0.001)
   1PRINT 570, NAMEOL, PCNTFO, PCNTFA
375 CONTINUE
    IF (LEMONE.GE.2) GO TO 610
    LEMONE=LEMONE+1
    UTEP=100.0/ASUM
    PRINT 26,K,A,B
    PRINT 17, ARRAY
 26 FORMAT (1H1,6(/),49X,7HSAMPLE,I3,2A1,8H + FUDGE  )
    SIO2=SIO2A*UTEP
    TIO2=TIO2A*UTEP
    AL2O3=AL2O3A*UTEP
    FE2O3=FE2O3A*UTEP
    FEO=FEOA*UTEP
    XMNO=XMNOA*UTEP
    XMGO=XMGOA*UTEP
    CAO=CAOA*UTEP
    XNA2O=XNA2OA*UTEP
    XK2O=XK2OA*UTEP
    P2O5=P2O5A*UTEP
    OTHER=0.0
    IF(SIO2)30,30,40
410    FORMAT (20H ANORTHITE          )
420    FORMAT (20H BYTOWNITE           )
440    FORMAT (20H LABRADURITE        )
460    FORMAT (20H ANDESINE           )
470    FORMAT (50X,20HPLAGIOCLASE FELDSPAR/50X,5A4/50X,4H( AB,F7.3,3H AN,
      1F7.3,2H ) )
480    FORMAT (20H OLIGOCLASE         )
490    FORMAT (20H ALBITE             )
  510 FORMAT (20H FAYALITE            )
  520 FORMAT (20H FERROHORTONOLITE    )
  540 FORMAT (20H HORTONOLITE         )
  560 FORMAT (20H HYALOSIDERITE       )
  570 FORMAT (50X, 7HOLIVINE/50X,5A4/50X,4H( FO,F7.3,3H FA,F7.3,2H ) )
  580 FORMAT (20H CHRYSOLITE          )
  590 FORMAT (20 H FORSTERITE         )
  610 CONTINUE
      IF (LEMONE.GE.3) GO TO 620
      LEMONE=LEMONE + 1
      VAP=AP/3.189
      VRU=RU/4.250
      VC=C/3.988
      VQ=Q/2.648
      VXKP=XKP/2.610
      VXLC=XLC/2.480
      VOR=OR/2.551
      VCS=CS/2.938
      VWO=WO/2.909
      VXNE=XNE/2.623
      VAB=AB/2.617
      VFA=FA/4.393
```

(Table 3, continued)

```
      VFO=FO/3.214
      VEN=FN/3.198
      VFS=FS/3.5
      VHM=HM/5.274
      VXMT=XMT/5.200
      VAN=AN/2.762
      VXKS=XKS/2.500
      VXNS=XNS/2.400
      VSP=SP/3.250
      VXIL=XIL/4.786
      VAC=AC/3.500
      VDIWO=DIWO/2.909
      VDIEN=DIEN/3.198
      VDIFS=DIFS/3.500
      VHY=VEN+VFS
      VDI=VDIWO+VDIEN+VDIFS
      VOL=VFA+VFO+VCS
      VDIFINX=VQ+VXKP+VAB+VOR+VXNE+VXLC
      VCOLINX=VDI+VHY+VOL+VXMT+VXIL+VAP
      VASUM=(VAP+VXIL+VSP+VRU+VXKP+VXKS+VXNE+VAC+VXNS+VAN+VC+VXMT+VHM+VF
     1A+VCS      +VCS+VFO+VXLC+VWO+VEN+VOR+VAB+VFS+VQ+VDIWO+VDIEN+VDIFS)
      ADAMS=100.0/VASUM
      VDIFSB=VDIFS*ADAMS
      VAPB=VAP*ADAMS
      VDIENB=VDIEN*ADAMS
      VDIFSB=VDIFS*ADAMS
      VRUB=VRU*ADAMS
      VCB=VC*ADAMS
      VQB=VQ*ADAMS
      VXKPB=VXKP*ADAMS
      VXLCB=VXLC*ADAMS
      VORB=VOR*ADAMS
      VCSB=VCS*ADAMS
      VWOB=VWO*ADAMS
      VXNEB=VXNE*ADAMS
      VABB=VAB*ADAMS
      VFAB=VFA*ADAMS
      VFOB=VFO*ADAMS
      VENB=VEN*ADAMS
      VFSB=VFS*ADAMS
      VHMB=VHM*ADAMS
      VXMTB=VXMT*ADAMS
      VANB=VAN*ADAMS
      VXKSB=VXKS*ADAMS
      VXNSB=VXNS*ADAMS
      VSPB=VSP*ADAMS
      VXILB=VXIL*ADAMS
      VACB=VAC*ADAMS
      VDIWOB=VDIWO*ADAMS
      VHYB=VHY*ADAMS
      VDIB=VDI*ADAMS
      VOLB=VOL*ADAMS
      VDIFINXB=VDIFINX*ADAMS
      VCOLINXB=VCOLINX*ADAMS
      VASUMB=VASUM*ADAMS
  611 CONTINUE
      PRINT 27,K,A,B
   27 FORMAT (1H1,6(/),49X,6HSAMPLE,I4,2A1,/,49X,34HCALCULATED C.I.P.W.
     1VOLUME PERCENT)
      PRINT 17, ARRAY
      AP=VAPB
      DIEN=VDIENB
```

(Table 3, continued)

```
      DIFS=VDIFSB
      RU=VRUB
      C=VCB
      Q=VQB
      XKP=VXKPB
      XLC=VXLCB
      OR=VORB
      CS=VCSB
      WO=VWOB
      XNE=VXNEB
      AB=VABB
      FA=VFAB
      FO=VFOB
      EN=VENB
      FS=VFSB
      HM=VHMB
      XMT=VXMTB
      AN=VANB
      XKS=VXKSB
      XNS=VXNSB
      SP=VSPB
      XIL=VXILB
      AC=VACB
      DIWO=VDIWOB
      HY=VHYB
      DI=VDIB
      OL=VOLB
      DIFINX=VDIFINXB
      COLINX=VCOLINXB
      ASUM=VASUMB
      GO TO 277
  620 CONTINUE
      IF (LEMONE.GE.4) GO TO 10
      LEMONE=LEMONE + 1
      QU=VQB
      KF=VORB
      PLAG=VABB+VANB
      FOIDS=VXNEB+VXLCB+VXKPB
      TOTQUAR=QU+KF+PLAG+FOIDS
      TOTPYAM=VSPB + VACB + VXNSB + VXKSB + VDIB + VHYB + VWOB
      TOTOLV=VOLB
      TOTORE=VXMTB + VXILB + VHMB + VRUB
      TOTAUX=VCB + VAPB
      TOTLEC=TOTQUAR + TOTAUX
      TOTMAF=TOTPYAM + TOTOLV + TOTORE
      TOTMEL=TOTMAF
      IF (PLAG.GT.0.0)
     1PCNTVAB=VABB/PLAG * 100.
      IF(TOTMAF.GT.0.0)
     1PCNTORE=TOTORE/TOTMAF * 100.
  970 IF(TOTLEC.LT. 5.0) GO TO 930
      IF(TOTLEC.LT.50.0) GO TO 920
      IF(TOTLEC.LT.95.0) GO TO 910
  960 IF(TOTLEC.GE.95.0) GO TO 900
  900 IF(PCNTVAB.GE.90.0) ENCODE (20,901,CONAME)
      IF(PCNTVAB.LT.90.0) ENCODE (20,902,CONAME)
      IF(PCNTVAB.LT.50.0) ENCODE (20,903,CONAME)
      IF(PCNTVAB.LT.10.0) ENCODE (20,904,CONAME)
      GO TO 975
  910 IF(PCNTVAB.GE.90.0) ENCODE (20,911,CONAME)
      IF(PCNTVAB.LT.90.0) ENCODE (20,912,CONAME)
      IF(PCNTVAB.LT.50.0) ENCODE (20,913,CONAME)
```

(Table 3, continued)

```
      IF(PCNTVAB.LT.10.0) ENCODE (20,914,CONAME)
      GO TO 975
  920 IF(PCNTVAB.GE.90.0) ENCODE (20,921,CONAME)
      IF(PCNTVAB.LT.90.0) ENCODE (20,922,CONAME)
      IF(PCNTVAB.LT.50.0) ENCODE (20,923,CONAME)
      IF(PCNTVAB.LT.10.0) ENCODE (20,924,CONAME)
      GO TO 975
  930 IF(PCNTORE.GE.90.0) ENCODE (20,931,CONAME)
      IF(PCNTORE.LT.90.0) ENCODE (20,932,CONAME)
      IF(PCNTORE.LT.50.0) ENCODE (20,933,CONAME)
      IF(PCNTORE.LT.10.0) ENCODE (20,934,CONAME)
  901 FORMAT (20H  CLASS 1  ORDER 1   )
  902 FORMAT (20H  CLASS 1  ORDER 2   )
  903 FORMAT (20H  CLASS 1  ORDER 3   )
  904 FORMAT (20H  CLASS 1  ORDER 4   )
  911 FORMAT (20H  CLASS 2  ORDER 1   )
  912 FORMAT (20H  CLASS 2  ORDER 2   )
  913 FORMAT (20H  CLASS 2  ORDER 3   )
  914 FORMAT (20H  CLASS 2  ORDER 4   )
  921 FORMAT (20H  CLASS 3  ORDER 1   )
  922 FORMAT (20H  CLASS 3  ORDER 2   )
  923 FORMAT (20H  CLASS 3  ORDER 3   )
  924 FORMAT (20H  CLASS 3  ORDER 4   )
  931 FORMAT (20H  CLASS 4  ORDER 1   )
  932 FORMAT (20H  CLASS 4  ORDER 2   )
  933 FORMAT (20H  CLASS 4  ORDER 3   )
  934 FORMAT (20H  CLASS 4  ORDER 4   )
      IF(TOTMAF.GT.0.0)
     1PCNTOLV=TOTOLV/TOTMAF * 100.
      IF (PCNTOLV.GE.95.0)  ENCODE (28 ,971,ZNAME)
      IF (PCNTOLV.LT.95.0)  ENCODE (28 ,972,ZNAME)
      IF (PCNTOLV.LT.50.0)  ENCODE (28 ,973,ZNAME)
      IF (PCNTOLV.LT. 5.0)  ENCODE (28 ,974,ZNAME)
      GO TO 621
  971 FORMAT(28H FAMILY 0                   )
  972 FORMAT (28H FAMILIES 1,2,3,4           )
  973 FORMAT (28H FAMILIES 5,6,7,8           )
  974 FORMAT (28H FAMILIES 9,10,11,12        )
  975 QUFOIDS=QU+FOIDS
      ENCODE (28,2000,ZNAME)
 2000 FORMAT (28X)
      KFPLAG= KF+PLAG
      IF(KFPLAG.GT.0.0)
     1PCNTKF= KF/KFPLAG*100.
      IF (QU.EQ.0.0) GO TO 977
      IF (TOTQUAR.GT.0.0)
     1PCNTQU=QU/TOTQUAR*100.
      IF (PCNTQU.LT. 5.0) GO TO 830
      IF (PCNTQU.LT.50.0) GO TO 820
      IF(PCNTQU.LT.95.0) GO TO 810
      IF (PCNTQU.GE.95.0) ENCODE (20,800,MNAME)
  977 IF (FOIDS.EQ.0.0) GO TO 621
      IF (TOTQUAR.GT.0.0)
     1PCNTFO=FOIDS/TOTQUAR*100.
      IF(PCNTFO.LT. 5.0) GO TO 840
      IF(PCNTFO.LT.50.0) GO TO 850
      IF(PCNTFO.LT.95.0) GO TO 860
      IF(PCNTFO.GE.95.0) ENCODE (20,870,MNAME)
  810 IF (PCNTKF.GE.95.0) ENCODE (20,816,MNAME)
      IF (PCNTKF.LT.95.0) ENCODE (20,817,MNAME)
      IF (PCNTKF.LT.50.0) ENCODE (20,818,MNAME)
      IF (PCNTKF.LT. 5.0) ENCODE(20,819,MNAME)
```

(Table 3, continued)

```
      GO TO 621
  820 IF (PCNTKF.GE.95.0) ENCODE (20,826,MNAME)
      IF (PCNTKF.LT.95.0) ENCODE (20,827,MNAME)
      IF (PCNTKF.LT.50.0) ENCODE (20,828,MNAME)
      IF (PCNTKF.LT. 5.0) ENCODE (20,829,MNAME)
      GO TO 621
  830 IF (PCNTKF.GE.95.0) ENCODE (20,836,MNAME)
      IF (PCNTKF.LT.95.0) ENCODE (20,837,MNAME)
      IF (PCNTKF.LT.50.0) ENCODE (20,838,MNAME)
      IF (PCNTKF.LT. 5.0) ENCODE (20,839,MNAME)
      GO TO 621
  840 IF (PCNTKF.GE.95.0) ENCODE (20,846,MNAME)
      IF (PCNTKF.LT.95.0) ENCODE (20,847,MNAME)
      IF (PCNTKF.LT.50.0) ENCODE (20,848,MNAME)
      IF (PCNTKF.LT. 5.0) ENCODE (20,849,MNAME)
      GO TO 621
  850 IF (PCNTKF.GE.95.0) ENCODE (20,856,MNAME)
      IF (PCNTKF.LT.95.0) ENCODE (20,857,MNAME)
      IF (PCNTKF.LT.50.0) ENCODE (20,858,MNAME)
      IF (PCNTKF.LT. 5.0) ENCODE (20,859,MNAME)
      GO TO 621
  860 IF (PCNTKF.GE.95.0) ENCODE (20,866,MNAME)
      IF (PCNTKF.LT.95.0) ENCODE (20,867,MNAME)
      IF (PCNTKF.LT.50.0) ENCODE (20,868,MNAME)
      IF (PCNTKF.LT. 5.0) ENCODE (20,869,MNAME)
  800 FORMAT (20HFAMILY  0           )
  816 FORMAT (20HFAMILY  1           )
  817 FORMAT (20HFAMILY  2           )
  818 FORMAT (20HFAMILY  3           )
  819 FORMAT (20HFAMILY  4           )
  826 FORMAT (20HFAMILY  5           )
  827 FORMAT (20HFAMILY  6           )
  828 FORMAT (20HFAMILY  7           )
  829 FORMAT (20HFAMILY  8           )
  836 FORMAT (20HFAMILY  9           )
  837 FORMAT (20HFAMILY 10           )
  838 FORMAT (20HFAMILY 11           )
  839 FORMAT (20HFAMILY 12           )
  846 FORMAT (20HFAMILY 13           )
  847 FORMAT (20HFAMILY 14           )
  848 FORMAT (20HFAMILY 15           )
  849 FORMAT (20HFAMILY 16           )
  856 FORMAT (20HFAMILY 17           )
  857 FORMAT (20HFAMILY 18           )
  858 FORMAT (20HFAMILY 19           )
  859 FORMAT (20HFAMILY 20           )
  866 FORMAT (20HFAMILY 21           )
  867 FORMAT (20HFAMILY 22           )
  868 FORMAT (20HFAMILY 23           )
  869 FORMAT (20HFAMILY 24           )
  870 FORMAT (20HFAMILY 25           )
  621 CONTINUE
      PRINT 37,K,A,B
   37 FORMAT(1H1,49X,6HSAMPLE,I4,2A1,/,49X,25HJOHANNSEN  CLASSIFICATION
     1,///)
      PRINT 17, ARRAY
      PRINT  1010
 1010 FORMAT (30X,14H1. QUARFELOIDS)
      PRINT 1020,  VQB
 1020 FORMAT (34X,14HA. (QU) QUARTZ,18X,F7.3)
      PRINT 1030,  VORB
 1030 FORMAT (34X,18HB. (KF) ORTHOCLASE,14X,F7.3)
```

(Table 3, continued)

```
      PRINT 1040,  VABB
 1040 FORMAT (34X,17HC.  (VABB) ALBITE,15X,F7.3)
      PRINT 1050,  VANB
 1050 FORMAT (42X,11H+ ANORTHITE,13X,F7.3)
      PRINT 1060,  PLAG
 1060 FORMAT (37X,17HTOTAL PLAGIOCLASE,12X,F7.3)
      PRINT 1070,  VXNEB
 1070 FORMAT (34X,20HD. (VXNEB) NEPHELINE,12X,F7.3)
      PRINT 1080,  VXLCB
 1080 FORMAT (45X,9H+ LEUCITE,12X,F7.3)
      PRINT 1090,  VXKPB
 1090 FORMAT (45X,15H+ KALIOPHYLLITE,6X,F7.3)
      PRINT 1100,  FOIDS
 1100 FORMAT (37X,18HTOTAL FELSPATHOIDS,11X,F7.3)
      PRINT 1110,  TOTQUAR
 1110 FORMAT(33X,27HTOTAL QUARFELOIDS (TOTQUAR),6X,F7.3)
      PRINT 1120
 1120 FORMAT (30X,10H2. MAFITES)
      PRINT 1130
 1130 FORMAT (34X,11HA.PYRIBOLES)
      PRINT 1140,  VSPB
 1140 FORMAT (39X,6HSPHENE,21X,F7.3)
      PRINT 1150,  VACB
 1150 FORMAT (37X,8H+ ACMITE,21X,F7.3)
      PRINT 1160,  VXNSB
 1160 FORMAT (37X,22H+ SODIUM METASILICATES,7X,F7.3)
      PRINT 1170,  VXKSB
 1170 FORMAT (37X,22H+ POTASH METASILICATES,7X,F7.3)
      PRINT 1180,  VDIB
 1180 FORMAT (37X,10H+ DIOPSIDE,19X,F7.3)
      PRINT 1190,  VHYB
 1190 FORMAT (37X, 13H+ HYPERSTHENE,16X,F7.3)
      PRINT 1200,  VWOB
 1200 FORMAT (37X,14H+ WOLLASTONITE,15X,F7.3)
      PRINT 1210,  TOTPYAM
 1210 FORMAT (35X,16HTOTAL  (TOTPYAM),14X,F7.3)
      PRINT 1220
 1220 FORMAT (34X,10HB. OLIVINE)
      PRINT 1221,  VFOB
 1221 FORMAT (39X,10HFORSTERITE,17X,F7.3)
      PRINT 1222,  VFAB
 1222 FORMAT (39X,8HFAYALITE,19X,F7.3)
      PRINT 1223,  VCSB
 1223 FORMAT (39X,16HCA ORTHOSILICATE,11X,F7.3)
      PRINT 1230, VOLB
 1230 FORMAT (36X,14HTOTAL  OLIVINE,16X,F7.3,//)
      PRINT 1240
 1240 FORMAT (34X,7HC. ORES)
      PRINT 1250,  VXMTB
 1250 FORMAT (39X,9HMAGNETITE,18X,F7.3)
      PRINT 1260,  VXILB
 1260 FORMAT (39X,8HILMENITE,19X,F7.3)
      PRINT 1270,  VHMB
 1270 FORMAT (39X,8HHEMATITE,19X,F7.3)
      PRINT 1280,  VRUB
 1280 FORMAT (39X,6HRUTILE,21X,F7.3)
      PRINT 1290,  TOTORE
 1290 FORMAT (37X,18HTOTAL ORE (TOTORE),11X,F7.3,//)
      PRINT 1300
 1300 FORMAT (30X,25H3. AUXILIARY CONSTITUENTS)
      PRINT 1310,  VCB
 1310 FORMAT (39X,8HCORUNDUM,19X,F7.3)
```

(Table 3, continued)

```
      PRINT 1320,  VAP3                                                          T
 1320 FORMAT (39X,7HAPATITE,20X,F7.3)                                            T
      PRINT 1330, TOTAUX                                                         T
 1330 FORMAT (37X,24HTOTAL AUXILIARY (TOTAUX),5X,F7.3,//)                        T
      PRINT 1340,  TOTLEC                                                        T
 1340 FORMAT (50X,11HLEUCOCRATES,18X,F7.3)                                       T
      PRINT 1350,  TOTMEL                                                        T
 1350 FORMAT (50X,10HMELOCRATES,19X,F7.3,///)                                    T
      PRINT 1360,  CONAME                                                        T
 1360 FORMAT(40X,6HCONAME,14X,5A4)                                               T
      PRINT 1370,  MNAME                                                         T
 1370 FORMAT (40X,5HMNAME,15X,5A4)                                               T
      PRINT 1380,  ZNAME                                                         T
 1380 FORMAT (40X,5HZNAME,15X,7A4)                                               T
      GO TO 620                                                                  T
  380 END                                                                        T

                FORTRAN DIAGNOSTIC RESULTS  FOR    ROCKDATA



 NULL STATEMENT NUMBERS
       960          970          911          70
LOAD,56
RUN,10,NA
```

ROCKPLOT EXPLANATION

2. 2 = number of plots

3. 2 and 4 = number of points for each plot in order (field of three).

4. X axis percentage range (0.0-100.0).

5. 9.0 and 9.0 are dimensions on plotter paper of graph.

6. Y axis percentage range (0.0-100.00).
7. Title card plot 1.

8. Title card plot 2.

9. Axis title
10. Axis title.

TABLE 4 -- Program Rockplot (14 pages)

```
                                   31/32/3300 FORTRAN (3.1)/MSOS   06/09/70
      PROGRAM ROCKPLOT
      INTEGER A,B,ZNAME,CONAME
C
C     ORIGINAL CIPW CALCULATION PROGRAMMED FOR IBM MACHINE PENN. STATE UP
C     BY CHARLES W. ONDRICK AND JOHN HOLLOWAY (1967)
C     MODIFIED TO CDC 3100 B BY DAVID V. LE MONE AND MARSHALL W. ADAMS
C     UNIVERSITY TEXAS EL PASO (1969)
C     PHASE 1, CIPW RECALCULATED TO 100 PERCENT (+ FUDGE)
C     LE MONE AND ADAMS, UNIV. TEXAS EL PASO (1969)
C     PHASE 2, PLAGIOCLASE CALCULATION, UTEP, LE MONE AND ADAMS (1969)
C     PHASE 3, OLIVINE CALCULATION, UTEP, LE MONE (1969)
C     PHASE 4, CIPW CALCULATION TO VOLUME PERCENT CONVERSION
C     UNIV. TEXAS EL PASO, LEMONE (1969)
C     PHASE 5, ARTIFICIAL JOHANNSEN CLASSIFICATION COMPUTATION
C     UNIV. TEXAS EL PASO, LEMONE (1969)
C     PHASE 6, DIFFERENTIATION INDEX CALCULATION (DIFINX)
C     UNIV. TEXAS EL PASO, LEMONE (1969)
C     PHASE 7, COLOR INDEX CALCULATION (COLINX)
C     UNIV. TEXAS EL PASO, LEMONE (1969)
C     PHASE 8, SUBROUTINE SUBPLOT, MULTIPLE AND SINGLE
C     UNIV. TEXAS EL PASO, LEMONE (1969)
C
C
C     GLOSSARY OF PROGRAM TERMS
C     NAME=PLAGIOCLASE FELDSPAR MINERAL NAME
C     ARRAY=ALPHANUMERIC LABEL
C     NAMEOL=OLIVINE MINERAL NAME
C     MNAME=JOHANNSEN FAMILY FOR CLASSES 1 TO 3 (ARTIFICIAL SYSTEM)
C     ZNAME=JOHANNSEN FAMILIES FOR CLASS 4 (ARTIFICIAL SYSTEM)
C     CONAME=JOHANNSEN CLASS AND ORDER
C     PCNTAB=PERCENTAGE OF ALBITE IN PLAGIOCLASE FELDSPAR
C     PCNTAN=PERCENTAGE OF ANORTHITE IN PLAGIOCLASE FELDSPAR
C     PCNTFO=PERCENTAGE OF FORSTERITE IN OLIVINE
C     PCNTFA=PERCENTAGE OF FAYALITE IN OLIVINE
C     DIFINX=DIFFERENTIATION INDEX
C     COLINX=COLOR INDEX
C     TOTQUAR=TOTAL QUARFELOIDS
C     TOTPYAM=TOTAL PYRIBOLES
C     TOTORE=TOTAL ORE
C     TOTAUX=TOTAL AUXILIARY CONSTITUENTS (CORUNDUM + APATITE)
C     TOTLEC=TOTAL LEUCOCRATES (TOTQUAR + TOTAUX)
C     TOTMEL=TOTAL MELOCRATES  (TOTPYAM + TOTOLV + TOTORE)
C     FOIDS=TOTAL FELSPATHOIDS
C
C
      DIMENSION NAME (5), ARRAY (10), NAMEOL (5),
     1MNAME (5), ZNAME (7), CONAME (5)
      REAL KF,KFPLAG
      COMMON DDIFINX (1000) , SSIO2 (1000) , NPTS
      REWIND 49
      REWIND 10
      NPTS=0
   10 READ15     ,K,A,B,SIO2,TIO2,AL203,FE203,FEO,XMNO,XMGO,CAO,XNA20,XK2
     1O,P205,OTHER
   15 FORMAT(I3,2A1,7F10.5/5X,7F10.5)
      READ 16, ARRAY
   16 FORMAT (10A8)
      SIO2A=SIO2
      TIO2A=TIO2
      AL203A=AL203
```

(Table 4, continued)

```
      FE203A=FE203                                                                   P
      FEOA=FEO                                                                       P
      XMNOA=XMNO                                                                     P
      XMGOA=XMGO                                                                     P
      CAOA=CAO                                                                       P
      XNA2OA=XNA20                                                                   P
      XK20A=XK20                                                                     P
      P205A=P205                                                                     P
      LEMONE=1                                                                       P
      UTEP=1.0                                                                       P
      IF(K-999)20     ,380     ,380                                                  P
   20 CONTINUE                                                                       P
C  20 PRINT25     ,K,A,3                                                             P
   25 FORMAT(1H1,5(/),49X,6HSAMPLE,I3,2A1)                                           P
      IF(SIO2)30     ,30     ,40                                                     P
   30 CONTINUE                                                                       P
C  30 PRINT 17, ARRAY                                                                P
   17 FORMAT (/,35X,10A8)                                                            P
C     PRINT 35                                                                       P
   35 FORMAT(1H0,34X,30HTHIS SAMPLE CONTAINS NO SILICA)                              P
      GO TO 375                                                                      P
   40 CONTINUE                                                                       P
C  40 PRINT45                                                                        P
   45 FORMAT(1H0,34X,54HTHE CHEMICAL COMPOSITION OF THE ROCK IN WEIGHT PP
     1ERCENT)                                                                        P
C     PRINT50                                                                        P
   50 FORMAT(1H0,5X,4HSIO2,6X,4HTIO2,5X,5HAL203,5X,5HFE203,7X,3HFEO,7X,3P
     1HMNO,7X,3HMGO,7X,3HCAO,6X,4HNA20,7X,3HK20,6X,4HP205,5X,5HOTHER)                P
C    15,OTHER                                                                        P
C     PRINT55     ,SIO2,TIO2,AL203,FE203,FEO,XMNO,XMGO,CAO,XNA20,XK20,P20P
   55 FORMAT(1H ,4X,11(F6.3,4X),F5.3)                                                P
      BSUM=(SIO2+TIO2+AL203+FE203+FEO+XMNO+XMGO+CAO+XNA20+XK20+P205)                 P
C     PRINT60     ,BSUM                                                              P
   60 FORMAT(1H ,34X,3HSUM,23X,F7.3)                                                 P
C     PRINT65                                                                        P
   65 FORMAT(1H0,49X,31H   *     *     *     *     *     *      )                    P
C             CALCULATION OF THE C.I.P.W. NORM                                       P
   70 AP=0.0                                                                         P
      XIL=0.0                                                                        P
      SP=0.0                                                                         P
      RU=0.0                                                                         P
      XKS=0.0                                                                        P
      XKP=0.0                                                                        P
      XLC=0.0                                                                        P
      OR=0.0                                                                         P
      XNS=0.0                                                                        P
      XNF=0.0                                                                        P
      AB=0.0                                                                         P
      AN=0.0                                                                         P
      C=0.0                                                                          P
      XMT=0.0                                                                        P
      HM=0.0                                                                         P
      Q=0.0                                                                          P
      OL=0.0                                                                         P
      FO=0.0                                                                         P
      FA=0.0                                                                         P
      CS=0.0                                                                         P
      DI=0.0                                                                         P
      WO=0.0                                                                         P
      EN=0.0                                                                         P
      FS=0.0                                                                         P
      HY=0.0                                                                         P
```

(Table 4, continued)

```
      XMO=0.0
      AC=0.0
C     MOLECULAR PROPORTIONS CALCULATED
      SI02=SI02/60.09
      TI02=TI02/79.90
      AL203=AL203/101.96
      FE203=FE203/159.70
      FEO=FEO/71.85
      XMNO=XMNO/70.94
      XMGO=XMGO/40.32
      CAO=CAO/56.08
      XNA20=XNA20/61.982
      XK20=XK20/94.20
      P205=P205/141.950
C     PRINT75
   75 FORMAT(1H0,45X,21HMOLECULAR PROPORTIONS)
C     PRINT80    ,SI02,TI02,AL203,FE203,FEO,XMNO,XMGO,CAO,XNA20,XK20,P20
C    15
   80 FORMAT(1H ,4X,11(F6.4,4X))
      FEO=FEO+XMNO
C     P205 TO APATITE
      AP=P205
      CAO=CAO-3.3  *P205
C     TI02 TO ILMENITE. SPHENE, RUTILE
      IF(FEO-TI02)90     ,85     ,85
   85 XIL=TI02
      FEO=FEO-TI02
      GO TO 105
   90 XIL=FEO
      TI02=TI02-FEO
      FEO=0.0
      IF(CAO-TI02)100    ,95     ,95
   95 SP=TI02
      CAO=CAO-TI02
      GO TO 105
  100 SP=CAO
      TI02=TI02-CAO
      CAO=0.0
      RU=TI02
C     K20 TO KALIOPHILITE AND POTASSIUM METASILICATE
  105 IF(AL203-XK20)115    ,110    ,110
  110 XKP=XK20
      AL203=AL203-XK20
      GO TO 120
  115 XKP=AL203
      XK20=XK20-AL203
      AL203=0.0
      XKS=XK20
C     NA20  TO NEPHELINE, ACMITE, SODIUM METASILICATE
  120 IF(AL203-XNA20)130    ,125    ,125
  125 XNE=XNA20
      AL203=AL203-XNA20                                      AL203
      GO TO 145
  130 XNE=AL203
      XNA20=XNA20-AL203
      AL203=0.0
      IF(FE203-XNA20)140    ,135    ,135
  135 AC=XNA20
      FE203=FE203-XNA20
      GO TO 145
  140 AC=FE203
      XNA20=XNA20-FE203
```

(Table 4, continued)

```
      FE203=0.0
      XNS=XNA20
C     AL203 TO ANORTHITE AND CORUNDUM
  145 IF(CAO-AL203)155    ,155    ,150
  150 AN=AL203
      CAO=CAO-AL203
      GO TO 160
  155 AN=CAO
      AL203=AL203-CAO
      CAO=0.0
      C=AL203
C     FE203 TO MAGNETITE, HEMATITE
  160 IF(FE203-FEO)165    ,165    ,170
  165 XMT=FE203
      FEO=FEO-FE203
      GO TO 175
  170 XMT=FEO
      FE203=FE203-FEO
      FEO=0.0
      HM=FE203
C     CAO, MGO, FEO TO OLIVINE, MONTICELLITE, CALCIUM ORTHOSILICATE
  175 XMGFE=XMGO+FEO
      RMGFE=XMGO/XMGFE
      IF(XMGFE-CAO)180    ,185    ,185
  180 XMO=XMGFE
      CAO=CAO-XMGFE
      CS=CAO
      GO TO 190
  185 XMO=CAO
      XMGFE=XMGFE-CAO
      OL=XMGFE
  190 SI02=SI02-SP-(2.0*XKP)-XKS-(2.0*XNE)-(4.0*AC)-XNS-(2.0*AN)-XMO-(CS
     1/2.0)-(OL/2.0)
      IF(SI02)195    ,270    ,205
  195 CONTINUE
C 195 PRINT200    ,SI02
  200 FORMAT(1H0,29X,52HNOT ENOUNGH SI02 TO FORM ALL UNDERSATURATED MINE
     1RALS,10X,7HSI02 = ,F5.3)
C  CHECK PRINT CIRL. CHR.
      GO TO 375
  205 XXXKP=XKP*2.0
      IF(SI02-XXXKP)210    ,210    ,215
  210 XLC=SI02/2.0
      XKP=XKP-XLC
      GO TO 270
  215 XLC=XKP
      SI02=SI02-XXXKP
      XKP=0.0
      CCSS=CS/2.0
      IF(SI02-CCSS)220    ,220    ,225
  220 WO=2.0 *SI02
      CS=CS-WO
      GO TO 270
  225 WO=CS
      SI02=SI02-CCSS
      CS=0.0
      IF(SI02-XMO)230    ,230    ,235
  230 DI=SI02
      XMO=XMO-SI02
      GO TO 270
  235 DI=XMO
      SI02=SI02-XMO
```

(Table 4, continued)

```
      XMO=0.0
      XXXLC=XLC*2.0
      IF(SIO2-XXXLC)240    ,240    ,245
  240 OR=SIO2/2.0
      XLC=XLC-OR
      GO TO 270
  245 OR=XLC
      SIO2=SIO2-XXXLC
      XLC=0.0
      XXXNE=XNE*4.0
      IF(SIO2-XXXNE)250    ,250    ,255
  250 AB=SIO2/4.0
      XNE=XNE-AB
      GO TO 270
  255 AB=XNE
      SIO2=SIO2-XXXNE
      XNE=0.0
      XXXOL=OL/2.0
      IF(SIO2-XXXOL)260    ,260    ,265
  260 HY=SIO2*2.0
      OL=OL-HY
      GO TO 270
  265 HY=OL
      SIO2=SIO2-XXXOL
      OL=0.0
      Q=SIO2
C     CONVERSION TO WEIGHT PERCENT
  270 R=1.0 -RMGFE
      CS=CS+XMO
      XMOOL=XMO+OL
      FO=RMGFE*XMOOL
      FA=R*XMOOL
      EN=HY*RMGFE
      FS=HY*R
      DIWO=DI*1.0
      DIEN=DI*RMGFE
      DIFS=DI*R
      AP=AP*328.88
      RU=RU*79.90
      C=C*101.96
      Q=Q*60.09
      XKP=XKP*316.34
      XLC=XLC*436.52
      OR=OR*556.70
      CS=CS*86.125
      WO=WO*116.17
      XNE=XNE*284.122
      AB=AB*524.482
      FA=FA*101.895
      FO=FO*70.365
      EN=EN*100.41
      FS=FS*131.94
      HM=HM*159.70
      XMT=XMT*231.55
      AN=AN*278.22
      XKS=XKS*154.29
      XNS=XNS*122.07
      SP=SP*196.07
      XIL=XIL*151.75
      AC=AC*462.042
      DIWO=DIWO*116.17
      DIEN=DIEN*100.41
```

(Table 4, continued)

```
      DIFS=DIFS*131.94
      OL=FO+FA+CS
      DI=DIWO+DIEN+DIFS
      HY=EN+FS
      DIFINX=OR+AB+Q+XNE+XKP+XLC
      COLINX=DI+HY+OL+XMT+XIL+AP
      ASUM=(AP+XIL+SP+RU+XKP+XKS+XNE+AC+XNS+AN+C+XMT+HM+FA+CS+FO+XLC+WO+
     1EN+OR+AB+FS+Q+DIWO+DIEN+DIFS)
C     PRINT275
  275 FORMAT(1H0,29X,32HC.I.P.W. NORM(IN WEIGHT PERCENT))
  277 CONTINUE
C 277 PRINT 280,   AP         ,DIFINX
  280 FORMAT(1H ,34X,7HAPATITE,19X,F7.3,20X,21HDIFFERENTIATION INDEX,10X
     1,F7.3)
C     PRINT285    ,XIL        ,COLINX
  285 FORMAT(1H ,34X,8HILMENITE,18X,F7.3,20X,11HCOLOR INDEX,20X8F7.3)
C     PRINT290    ,SP
  290 FORMAT(1H ,34X,6HSPHENE,20X,F7.3)
C     PRINT295    ,RU
  295 FORMAT(1H ,34X,6HRUTILE,20X,F7.3)
C     PRINT300    ,XKS
  300 FORMAT(1H,34X,14HK-METASILICATE,12X,F7.3)
C     PRINT305    ,XKP
  305 FORMAT(1H ,34X,13HKALIOPHILLITE,13X,F7.3)
C     PRINT310    ,XLC
  310 FORMAT(1H ,34X,7HLEUCITE,19X,F7.3)
C     PRINT315    ,OR
  315 FORMAT(1H 34X,10HORTHOCLASE,16X,F7.3)
C     PRINT320    ,XNS
  320 FORMAT(1H ,34X,15HNA-METASILICATE,11X,F7.3)
C     PRINT325    ,XNE
      PABAN = AB/524.482 + AN/278.22
      IF (PABAN.GT.0.0)
     1PCNTAB = ((AB/524.482)/PABAN) * 100.
      IF (PABAN.GT.0.0)
     1PCNTAN = ((AN/278.22)/PABAN) * 100.
      IF(PCNTAB.GE.90.0)ENCODE(20,490,NAME)
      IF(PCNTAB.LT.90.0)ENCODE(20,480,NAME)
      IF(PCNTAB.LT.70.0)ENCODE(20,460,NAME)
      IF(PCNTAB.LT.50.0)ENCODE(20,440,NAME)
      IF(PCNTAB.LT.30.0)ENCODE(20,420,NAME)
      IF(PCNTAB.LT.10.0)ENCODE(20,410,NAME)
      PFOFA = FO/70.365 + FA/101.895
      IF (PFOFA.GT.0.0)
     1PCNTFO = ((FO/70.365)/PFOFA) * 100.
      IF (PFOFA.GT.0.0)
     1PCNTFA = ((FA/101.895)/PFOFA) * 100.
      IF (PCNTFO.GE.90.0) ENCODE (20,590,NAMEOL)
      IF (PCNTFO.LT.90.0) ENCODE (20,580,NAMEOL)
      IF (PCNTFO.LT.70.0) ENCODE (20,560,NAMEOL)
      IF (PCNTFO.LT.50.0) ENCODE (20,540,NAMEOL)
      IF (PCNTFO.LT.30.0) ENCODE (20,520,NAMEOL)
      IF (PCNTFO.LT.10.0) ENCODE (20,510,NAMEOL)
  325 FORMAT(1H ,34X,9HNEPHELINE,17X,F7.3)
C     PRINT330    ,AB
  330 FORMAT(1H ,34X,6HALBITE,20X,F7.3)
C     PRINT335    ,AN
  335 FORMAT(1H ,34X,9HANORTHITE,17X,F7.3)
C     PRINT340    ,C
  340 FORMAT(1H ,34X,8HCORUNDUM,18X,F7.3)
C     PRINT345    ,XMT
  345 FORMAT(1H ,34X,9HMAGNETITE,17X,F7.3)
```

```
C     PRINT350   ,HM
  350 FORMAT(1H ,34X,8HHEMATITE,18X,F7.3)
C     PRINT355   ,Q
  355 FORMAT(1H ,34X,6HQUARTZ,20X,F7.3)
C     PRINT360   ,OL,FO,FA,CS
  360 FORMAT(1H ,34X,13HTOTAL OLIVINE,13X,F7.3,22H WITH THE COMPOSITION
     1,/40X,10HFORSTERITE,11X,F7.3/40X,8HFAYALITE,13X,F7.3/40X,16HCA-ORT
     2HOSILICATE,5X,F7.3)
C     PRINT365   ,DI,DIWO,DIEN,DIFS,HY,EN,FS,WO,AC
  365 FORMAT(1H ,34X,14HTOTAL DIOPSIDE,12X,F7.3,22H WITH THE COMPOSITION
     1,/40X,13HDIOPSIDE (WO),8X,F7.3/40X,13HDIOPSIDE (EN),8X,F7.3/40X,13
     2HDIOPSIDE (FS),8X,F7.3/35X,17HTOTAL HYPERSTHENE, 9X,F7.3,20HWITH T
     3HE COMPOSITION/40X,9HENSTATITE,12X,F7.3/40X,12HFERROSILLITE, 9X,F7
     4.3/35X,12HWOLLASTONITE,14X,F7.3/35X,6HACMITE,20X,F7.3)
C     PRINT370   ,ASUM
  370 FORMAT(1H ,34X,3HSUM,23X,F7.3)
C     PRINT65
C     IF (PABAN.GE.0.001)
C    1PRINT 470, NAME, PCNTAB, PCNTAN
C     IF (PFOFA.GE.0.001)
C    1PRINT 570, NAMEOL, PCNTFO, PCNTFA
  375 CONTINUE
      IF (LEMONE.GE.2) GO TO 610
      LEMONE=LEMONE+1
      UTEP=100.0/ASUM
C     PRINT 26,K,A,B
C     PRINT 17, ARRAY
   26 FORMAT (1H1,6(/),49X,7HSAMPLE,I3,2A1,8H + FUDGE  )
      SIO2=SIO2A*UTEP
      TIO2=TIO2A*UTEP
      AL2O3=AL2O3A*UTEP
      FE2O3=FE2O3A*UTEP
      FEO=FEOA*UTEP
      XMNO=XMNOA*UTEP
      XMGO=XMGOA*UTEP
      CAO=CAOA*UTEP
      XNA2O=XNA2OA*UTEP
      XK2O=XK2OA*UTEP
      P2O5=P2O5A*UTEP
      OTHER=0.0
      IF(SIO2)30,30,40
410   FORMAT (20H ANORTHITE          )
420   FORMAT (20H BYTOWNITE           )
440   FORMAT (20H LABRADORITE         )
460   FORMAT (20H ANDESINE            )
470   FORMAT (50X,20HPLAGIOCLASE FELDSPAR/50X,5A4/50X,4H( AB,F7.3,3H AN,
     1F7.3,2H ) )
480   FORMAT (20H OLIGOCLASE          )
490   FORMAT (20H ALBITE              )
  510 FORMAT (20H FAYALITE            )
  520 FORMAT (20H FERROHORTONOLITE    )
  540 FORMAT (20H HORTONOLITE         )
  560 FORMAT (20H HYALOSIDERITE       )
  570 FORMAT (50X, 7HOLIVINE/50X,5A4/50X,4H( FO,F7.3,3H FA,F7.3,2H ) )
  580 FORMAT (20H CHRYSOLITE          )
  590 FORMAT (20 H FORSTERITE         )
  610 CONTINUE
      IF (LEMONE.GE.3) GO TO 620
      LEMONE=LEMONE + 1
      VAP=AP/3.189
      VRU=RU/4.250
      VC=C/3.988
```

(Table 4, continued)

```
      VQ=Q/2.648
      VXKP=XKP/2.610
      VXLC=XLC/2.480
      VOR=OR/2.551
      VCS=CS/2.938
      VWO=WO/2.909
      VXNE=XNE/2.623
      VAB=AB/2.617
      VFA=FA/4.393
      VFO=FO/3.214
      VEN=EN/3.198
      VFS=FS/3.5
      VHM=HM/5.274
      VXMT=XMT/5.200
      VAN=AN/2.762
      VXKS=XKS/2.500
      VXNS=XNS/2.400
      VSP=SP/3.250
      VXIL=XIL/4.786
      VAC=AC/3.500
      VDIWO=DIWO/2.909
      VDIEN=DIEN/3.198
      VDIFS=DIFS/3.500
      VHY=VEN+VFS
      VDI=VDIWO+VDIEN+VDIFS
      VOL=VFA+VFO+VCS
      VDIFINX=VQ+VXKP+VAB+VOR+VXNE+VXLC
      VCOLINX=VDI+VHY+VOL+VXMT+VXIL+VAP
      VASUM=(VAP+VXIL+VSP+VRU+VXKP+VXKS+VXNE+VAC+VXNS+VAN+VC+VXMT+VHM+VF
     1A+VCS      +VCS+VFO+VXLC+VWO+VEN+VOR+VAB+VFS+VQ+VDIWO+VDIEN+VDIFS)
      ADAMS=100.0/VASUM
      VDIFSB=VDIFS*ADAMS
      VAPB=VAP*ADAMS
      VDIENB=VDIEN*ADAMS
      VDIFSB=VDIFS*ADAMS
      VRUB=VRU*ADAMS
      VCB=VC*ADAMS
      VQB=VQ*ADAMS
      VXKPB=VXKP*ADAMS
      VXLCB=VXLC*ADAMS
      VORB=VOR*ADAMS
      VCSB=VCS*ADAMS
      VWOB=VWO*ADAMS
      VXNEB=VXNE*ADAMS
      VABB=VAB*ADAMS
      VFAB=VFA*ADAMS
      VFOB=VFO*ADAMS
      VENB=VEN*ADAMS
      VFSB=VFS*ADAMS
      VHMB=VHM*ADAMS
      VXMTB=VXMT*ADAMS
      VANB=VAN*ADAMS
      VXKSB=VXKS*ADAMS
      VXNSB=VXNS*ADAMS
      VSPB=VSP*ADAMS
      VXILB=VXIL*ADAMS
      VACB=VAC*ADAMS
      VDIWOB=VDIWO*ADAMS
      VHYB=VHY*ADAMS
      VDIB=VDI*ADAMS
      VOLB=VOL*ADAMS
      VDIFINXB=VDIFINX*ADAMS
```

(Table 4, continued)

```
      VCOLINXB=VCOLINX*ADAMS
      VASUMB=VASUM*ADAMS
  611 CONTINUE
C     PRINT 27,K,A,B
   27 FORMAT (1H1,6(/),49X,6HSAMPLE,I4,2A1,/,49X,34HCALCULATED C.I.P.W.
     1VOLUME PERCENT)
C     PRINT 17, ARRAY
      AP=VAPB
      DIEN=VDIENB
      DIFS=VDIFSB
      RU=VRUB
      C=VCB
      Q=VQB
      XKP=VXKPB
      XLC=VXLCB
      OR=VORB
      CS=VCSB
      WO=VWOB
      XNE=VXNEB
      AB=VABB
      FA=VFAB
      FO=VFOB
      EN=VENB
      FS=VFSB
      HM=VHMB
      XMT=VXMTB
      AN=VANB
      XKS=VXKSB
      XNS=VXNSB
      SP=VSPB
      XIL=VXILB
      AC=VACB
      DIWO=VDIWOB
      HY=VHYB
      DI=VDIB
      OL=VOLB
      ASUM=VASUMB
      GO TO 277
  620 CONTINUE
      SIO2=SIO2A*UTEP
      IF (LEMONE.GE.4)622,623
  622 WRITE(49) COLINX,DIFINX,SIO2
      WRITE (10) ARRAY
      NPTS=NPTS+1
      GO TO 10
  623 LEMONE=LEMONE+1
      QU=VQB
      KF=VORB
      PLAG=VABB+VANB
      FOIDS=VXNEB+VXLCB+VXKPB
      TOTQUAR=QU+KF+PLAG+FOIDS
      TOTPYAM=VSPB + VACB + VXNSB + VXKSB + VDIB + VHYB + VWOB
      TOTOLV=VOLB
      TOTORE=VXMTB + VXILB + VHMB + VRUB
      TOTAUX=VCB + VAPB
      TOTLEC=TOTQUAR + TOTAUX
      TOTMAF=TOTPYAM + TOTOLV + TOTORE
      TOTMFL=TOTMAF
      IF (PLAG.GT.0.0)
     1PCNTVAB=VABB/PLAG * 100.
      IF(TOTMAF.GT.0.0)
     1PCNTORE=TOTORE/TOTMAF * 100.
```

(Table 4, continued)

```
  970 IF(TOTLEC.LT. 5.0) GO TO 930
      IF(TOTLEC.LT.50.0) GO TO 920
      IF(TOTLEC.LT.95.0) GO TO 910
  960 IF(TOTLEC.GE.95.0) GO TO 900
  900 IF(PCNTVAB.GE.90.0) ENCODE (20,901,CONAME)
      IF(PCNTVAB.LT.90.0) ENCODE (20,902,CONAME)
      IF(PCNTVAB.LT.50.0) ENCODE (20,903,CONAME)
      IF(PCNTVAB.LT.10.0) ENCODE (20,904,CONAME)
      GO TO 975
  910 IF(PCNTVAB.GE.90.0) ENCODE (20,911,CONAME)
      IF(PCNTVAB.LT.90.0) ENCODE (20,912,CONAME)
      IF(PCNTVAB.LT.50.0) ENCODE (20,913,CONAME)
      IF(PCNTVAB.LT.10.0) ENCODE (20,914,CONAME)
      GO TO 975
  920 IF(PCNTVAB.GE.90.0) ENCODE (20,921,CONAME)
      IF(PCNTVAB.LT.90.0) ENCODE (20,922,CONAME)
      IF(PCNTVAB.LT.50.0) ENCODE (20,923,CONAME)
      IF(PCNTVAB.LT.10.0) ENCODE (20,924,CONAME)
      GO TO 975
  930 IF(PCNTORE.GE.90.0) ENCODE (20,931,CONAME)
      IF(PCNTORF.LT.90.0) ENCODE (20,932,CONAME)
      IF(PCNTORE.LT.50.0) ENCODE (20,933,CONAME)
      IF(PCNTORE.LT.10.0) ENCODE (20,934,CONAME)
  901 FORMAT (20H  CLASS 1   ORDER 1   )
  902 FORMAT (20H  CLASS 1   ORDER 2   )
  903 FORMAT (20H  CLASS 1   ORDER 3   )
  904 FORMAT (20H  CLASS 1   ORDER 4   )
  911 FORMAT (20H  CLASS 2   ORDER 1   )
  912 FORMAT (20H  CLASS 2   ORDER 2   )
  913 FORMAT (20H  CLASS 2   ORDER 3   )
  914 FORMAT (20H  CLASS 2   ORDER 4   )
  921 FORMAT (20H  CLASS 3   ORDER 1   )
  922 FORMAT (20H  CLASS 3   ORDER 2   )
  923 FORMAT (20H  CLASS 3   ORDER 3   )
  924 FORMAT (20H  CLASS 3   ORDER 4   )
  931 FORMAT (20H  CLASS 4   ORDER 1   )
  932 FORMAT (20H  CLASS 4   ORDER 2   )
  933 FORMAT (20H  CLASS 4   ORDER 3   )
  934 FORMAT (20H  CLASS 4   ORDER 4   )
      IF(TOTMAF.GT.0.0)
     1PCNTOLV=TOTOLV/TOTMAF * 100.
      IF (PCNTOLV.GE.95.0)  ENCODE (28 ,971,ZNAME)
      IF (PCNTOLV.LT.95.0)  ENCODE (28 ,972,ZNAME)
      IF (PCNTOLV.LT.50.0)  ENCODE (28 ,973,ZNAME)
      IF (PCNTOLV.LT. 5.0)  ENCODE (28 ,974,ZNAME)
      GO TO 621
  971 FORMAT(28H FAMILY 0                    )
  972 FORMAT (28H FAMILIES 1,2,3,4            )
  973 FORMAT (28H FAMILIES 5,6,7,8            )
  974 FORMAT (28H FAMILIES 9,10,11,12         )
  975 QUFOIDS=QU+FOIDS
      ENCODE (28,2000,ZNAME)
 2000 FORMAT (28X)
      KFPLAG= KF+PLAG
      IF(KFPLAG.GT.0.0)
     1PCNTKF= KF/KFPLAG*100.
      IF (QU.EQ.0.0) GO TO 977
      IF (TOTQUAR.GT.0.0)
     1PCNTQU=QU/TOTQUAR*100.
      IF (PCNTQU.LT. 5.0) GO TO 830
      IF (PCNTQU.LT.50.0) GO TO 820
      IF(PCNTQU.LT.95.0) GO TO 810
```

(Table 4, continued)

```
      IF (PCNTQU.GE.95.0) ENCODE (20,800,MNAME)
  977 IF (FOIDS.EQ.0.0) GO TO 621
      IF (TOTQUAR.GT.0.0)
     1PCNTFD=FOIDS/TOTQUAR*100.
      IF(PCNTFD.LT. 5.0) GO TO 840
      IF(PCNTFD.LT.50.0) GO TO 850
      IF(PCNTFD.LT.95.0) GO TO 860
      IF(PCNTFD.GE.95.0) ENCODE (20,870,MNAME)
  810 IF (PCNTKF.GE.95.0) ENCODE (20,816,MNAME)
      IF (PCNTKF.LT.95.0) ENCODE (20,817,MNAME)
      IF (PCNTKF.LT.50.0) ENCODE (20,818,MNAME)
      IF (PCNTKF.LT. 5.0) ENCODE(20,819,MNAME)
      GO TO 621
  820 IF (PCNTKF.GE.95.0) ENCODE (20,826,MNAME)
      IF (PCNTKF.LT.95.0) ENCODE (20,827,MNAME)
      IF (PCNTKF.LT.50.0) ENCODE (20,828,MNAME)
      IF (PCNTKF.LT. 5.0) ENCODE (20,829,MNAME)
      GO TO 621
  830 IF (PCNTKF.GE.95.0) ENCODE (20,836,MNAME)
      IF (PCNTKF.LT.95.0) ENCODE (20,837,MNAME)
      IF (PCNTKF.LT.50.0) ENCODE (20,838,MNAME)
      IF (PCNTKF.LT. 5.0) ENCODE (20,839,MNAME)
      GO TO 621
  840 IF (PCNTKF.GE.95.0) ENCODE (20,846,MNAME)
      IF (PCNTKF.LT.95.0) ENCODE (20,847,MNAME)
      IF (PCNTKF.LT.50.0) ENCODE (20,848,MNAME)
      IF (PCNTKF.LT. 5.0) ENCODE (20,849,MNAME)
      GO TO 621
  850 IF (PCNTKF.GE.95.0) ENCODE (20,856,MNAME)
      IF (PCNTKF.LT.95.0) ENCODE (20,857,MNAME)
      IF (PCNTKF.LT.50.0) ENCODE (20,858,MNAME)
      IF (PCNTKF.LT. 5.0) ENCODE (20,859,MNAME)
      GO TO 621
  860 IF (PCNTKF.GE.95.0) ENCODE (20,866,MNAME)
      IF (PCNTKF.LT.95.0) ENCODE (20,867,MNAME)
      IF (PCNTKF.LT.50.0) ENCODE (20,868,MNAME)
      IF (PCNTKF.LT. 5.0) ENCODE (20,869,MNAME)
  800 FORMAT (20HFAMILY 0             )
  816 FORMAT (20HFAMILY  1            )
  817 FORMAT (20HFAMILY  2            )
  818 FORMAT (20HFAMILY  3            )
  819 FORMAT (20HFAMILY  4            )
  826 FORMAT (20HFAMILY  5            )
  827 FORMAT (20HFAMILY  6            )
  828 FORMAT (20HFAMILY  7            )
  829 FORMAT (20HFAMILY  8            )
  836 FORMAT (20HFAMILY  9            )
  837 FORMAT (20HFAMILY 10            )
  838 FORMAT (20HFAMILY 11            )
  839 FORMAT (20HFAMILY 12            )
  846 FORMAT (20HFAMILY 13            )
  847 FORMAT (20HFAMILY 14            )
  848 FORMAT (20HFAMILY 15            )
  849 FORMAT (20HFAMILY 16            )
  856 FORMAT (20HFAMILY 17            )
  857 FORMAT (20HFAMILY 18            )
  858 FORMAT (20HFAMILY 19            )
  859 FORMAT (20HFAMILY 20            )
  866 FORMAT (20HFAMILY 21            )
  867 FORMAT (20HFAMILY 22            )
  868 FORMAT (20HFAMILY 23            )
  869 FORMAT (20HFAMILY 24            )
```

(Table 4, continued)

```
  870 FORMAT (20HFAMILY 25           )
  621 CONTINUE
C     PRINT 37,K,A,B
   37 FORMAT(1H1,49X,6HSAMPLE,I4,2A1,/,49X,25HJOHANNSEN  CLASSIFICATION
     1,///)
C     PRINT 17, ARRAY
C     PRINT  1010
 1010 FORMAT (30X,14H1. QUARFELOIDS)
C     PRINT 1020, .VQB
 1020 FORMAT (34X,14HA. (QU) QUARTZ,18X,F7.3)
C     PRINT 1030,  VORB
 1030 FORMAT (34X,18HB. (KF) ORTHOCLASE,14X,F7.3)
C     PRINT 1040,  VABB
 1040 FORMAT (34X,17HC.. (VABB) ALBITE,15X,F7.3)
C     PRINT 1050,  VANB
 1050 FORMAT (42X,11H+ ANORTHITE,13X,F7.3)
C     PRINT 1060,  PLAG
 1060 FORMAT (37X,17HTOTAL PLAGIOCLASE,12X,F7.3)
C     PRINT 1070,  VXNEB
 1070 FORMAT (34X,20HD. (VXNEB) NEPHELINE,12X,F7.3)
C     PRINT 1080,  VXLCB
 1080 FORMAT (45X,9H+ LEUCITE,12X,F7.3)
C     PRINT 1090,  VXKPB
 1090 FORMAT (45X,15H+ KALIOPHYLLITE,6X,F7.3)
C     PRINT 1100,  FOIDS
 1100 FORMAT (37X,18HTOTAL FELSPATHOIDS,11X,F7.3)
C     PRINT 1110,  TOTQUAR
 1110 FORMAT(33X,27HTOTAL QUARFELOIDS (TOTQUAR),6X,F7.3)
C     PRINT 1120
 1120 FORMAT (30X,10H2. MAFITES)
C     PRINT 1130
 1130 FORMAT (34X,11HA.PYRIBOLES)
C     PRINT 1140,  VSPB
 1140 FORMAT (39X,6HSPHENE,21X,F7.3)
C     PRINT 1150,  VACB
 1150 FORMAT (37X,8H+ ACMITE,21X,F7.3)
C     PRINT 1160,  VXNSB
 1160 FORMAT (37X,22H+ SODIUM METASILICATES,7X,F7.3)
C     PRINT 1170,  VXKSB
 1170 FORMAT (37X,22H+ POTASH METASILICATES,7X,F7.3)
C     PRINT 1180,  VDIB
 1180 FORMAT (37X,10H+ DIOPSIDE,19XF7.3)
C     PRINT 1190,  VHYB
 1190 FORMAT (37X, 13H+ HYPERSTHENE,16X,F7.3)
C     PRINT 1200,  VWOB
 1200 FORMAT (37X,14H+ WOLLASTONITE,15X,F7.3)
C     PRINT 1210,  TOTPYAM
 1210 FORMAT (36X,16HTOTAL  (TOTPYAM),14X,F7.3)
C     PRINT 1220
 1220 FORMAT (34X,10HB. OLIVINE)
C     PRINT 1221,  VFOB
 1221 FORMAT (39X,10HFORSTERITE,17X,F7.3)
C     PRINT 1222,  VFAB
 1222 FORMAT (39X,8HFAYALITE,19X,F7.3)
C     PRINT 1223,  VCSB
 1223 FORMAT (39X,16HCA ORTHOSILICATE,11X,F7.3)
C     PRINT 1230, VOLB
 1230 FORMAT (36X,14HTOTAL  OLIVINE,16X,F7.3,//)
C     PRINT 1240
 1240 FORMAT (34X,7HC. ORES)
C     PRINT 1250,  VXMTB
 1250 FORMAT (39X,9HMAGNETITE,18X,F7.3)
```

(Table 4, continued)

```
C       PRINT 1260,  VXILB                                                      P
 1260 FORMAT (39X,8HILMENITE,19X,F7.3)                                          P
C       PRINT 1270,  VHMB                                                       P
 1270 FORMAT (39X,8HHEMATITE,19X,F7.3)                                          P
C       PRINT 1280,  VRUB                                                       P
 1280 FORMAT (39X,6HRUTILE,21X,F7.3)                                            P
C       PRINT 1290,  TOTORE                                                     P
 1290 FORMAT (37X,18HTOTAL ORE (TOTORE),11X,F7.3,//)                            P
C       PRINT 1300                                                              P
 1300 FORMAT (30X,25H3. AUXILIARY CONSTITUENTS)                                 P
C       PRINT 1310,  VCB                                                        P
 1310 FORMAT (39X,8HCORUNDUM,19X,F7.3)                                          P
C       PRINT 1320,  VAPB                                                       P
 1320 FORMAT (39X,7HAPATITE,20X,F7.3)                                           P
C       PRINT 1330, TOTAUX                                                      P
 1330 FORMAT (37X,24HTOTAL AUXILIARY (TOTAUX),5X,F7.3,//)                       P
C       PRINT 1340,  TOTLEC                                                     P
 1340 FORMAT (50X,11HLEUCOCRATES,18X,F7.3)                                      P
C       PRINT 1350,  TOTMEL                                                     P
 1350 FORMAT (50X,10HMELUCRATES,19X,F7.3,///)                                   P
C       PRINT 1360,  CONAME                                                     P
 1360 FORMAT(40X,6HCONAME,14X,5A4)                                              P
C       PRINT 1370,  MNAME                                                      P
 1370 FORMAT (40X,5HMNAME,15X,5A4)                                              P
C       PRINT 1380,  ZNAME                                                      P
 1380 FORMAT (40X,5HZNAME,15X,7A4)                                              P
      GO TO 620                                                                 P
  380 ENDFILE 49                                                                P
      REWIND 49                                                                 P
      REWIND 10                                                                 P
      CALL SUBPLOT                                                              P
      END                                                                       P
```

```
                    FORTRAN DIAGNOSTIC RESULTS  FOR    ROCKPLOT



NULL STATEMENT NUMBERS
      1380        1370        1360        1350        1340        1330        1
      1290        1280        1270        1260        1250        1240        1
      1221        1220        1210        1200        1190        1180        1
      1140        1130        1120        1110        1100        1090        1
      1050        1040        1030        1020        1010        37          9
      611         570         470         26          370         365         3
      345         340         335         330         325         320         3
      300         295         290         285         280         275         2
      70          65          55          50          45          35          1
```

(Table 4, continued)

```
      SUBROUTINE SUBPLOT                                                P
      COMMON DIFINX(1000),SI02(1000),NPTS                               P
      DIMENSION ARRAY (10)                                              P
      DIMENSION NP(50)                                                  P
      REWIND 49                                                         P
      PRINT 1000                                                        P
 1000 FORMAT (1H1)                                                      P
      READ 1500,N,(NP(I),I=1,N)                                         P
 1500 FORMAT (I2/(26I3))                                                P
      I = 1                                                             P
      DO 1 K = 1,N                                                      P
      NMAX = NP(K)                                                      P
      DO 2 J = 1,NMAX                                                   P
      READ (49) COLINX,DIFINX(I),SI02(I)                                P
      READ (10) ARRAY                                                   P
      PRINT 1400, COLINX,DIFINX(I),SI02(I),ARRAY                        P
    2 I = I + 1                                                         P
    1 PRINT 1000                                                        P
      READ 1400, SMIN,SMAX                                              P
      READ 1400, XLEN,YLEN                                              P
      READ 1400, DMIN,DMAX                                              P
 1400 FORMAT (3F10.5,5X,10A8)                                           P
      K = 1                                                             P
      DO 10 I = 1,N                                                     P
      NPTS = NP(I)                                                      P
      CALLPLOTTER(SI02(K),DIFINX(K),SMIN,SMAX,DMIN,DMAX,XLEN,YLEN,NPTS,3P
     1,-1,0,1,-1)                                                       P
   10 K = K + NP(I)                                                     P
      RETURN                                                            P
      END                                                               P

              FORTRAN DIAGNOSTIC RESULTS  FOR    SUBPLOT


NO ERRORS
LOAD,56
RUN,5
```