CHEMICAL CLASSIFICATION OF ROCKS BY DATA PROCESSING

OF 30

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New Mexico State Bureau of Mines and Mineral Resources

Open-file Report

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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Appendices

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	Appendix	1 - Program Rockdata	13 pages
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Numerically Indexed Artifical Johannsen Classification

Volume II	1100-1424
Volume III	2100-2210
Volume IV (Classified alphabetically by rock name)	2207
Volume V	2211-2323
Volume VI	2400-4424

Numerically Indexed Differentiation Index (DIFINX)

Volume VII	0.0-45.0
Volume VII	45.0-70.0
Volume IX	70.0-100.0

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 Johnannsen 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:

C. I. P. W. calculation which determines weight percent of normative minerals. Calculations for percent and type of olivine and plagio-

clase 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

INPUT (figure 1)

The program requires the data from the eleven standard oxides of whole-rock analyses. They are SiO2, TiO2, Al2O3, Fe2O3, FeO, M2O MnO, CaO, Na₂O, K₂O, and P₂O₅. 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 I. 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 analysis. This is to be done the 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 Pennsyl-

vania 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:

 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)

, ,ltt

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.

Pti cent and in early of ten percents and invalingle and which has virtually and agreement central

fileta.

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

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
50	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

accessible reference set.

(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

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.

plotter takes the parameters listed here, adds . 5 inch, and then truncates. parameters listed here, adds . 5 inch, and then truncates.

on the plotter. (Please note comment 5 on figure 3). The Calcomp

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, SIO2) 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;

numbered in a most are of this took is a continuous they are:

1) Genesis of rocks

were trained.

11 Cigneous rocks of similar designation may be visually sepagated by our similar

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 alrhyolite 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.

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MULTIPLE-CARD LAYOUT FORM

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Application ROCKDATA AND ROCKPLOT PROGRAMS	Date	Job No	Sheet No.
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Figure 1 -- Data input.

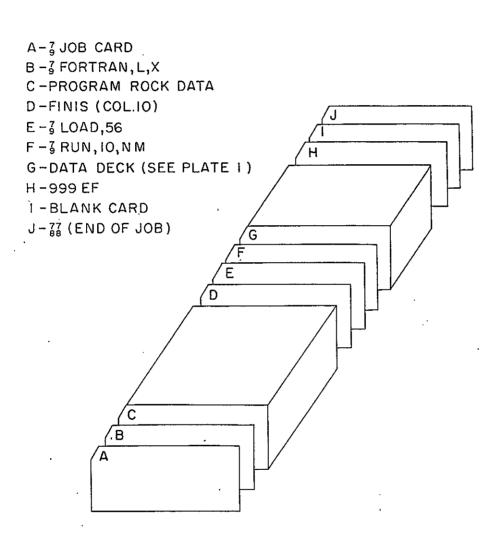
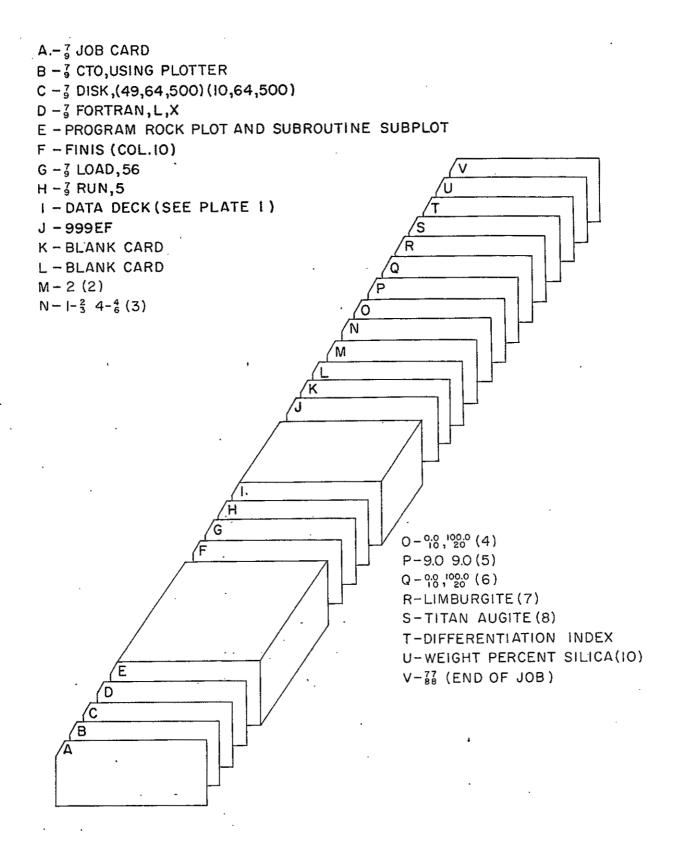
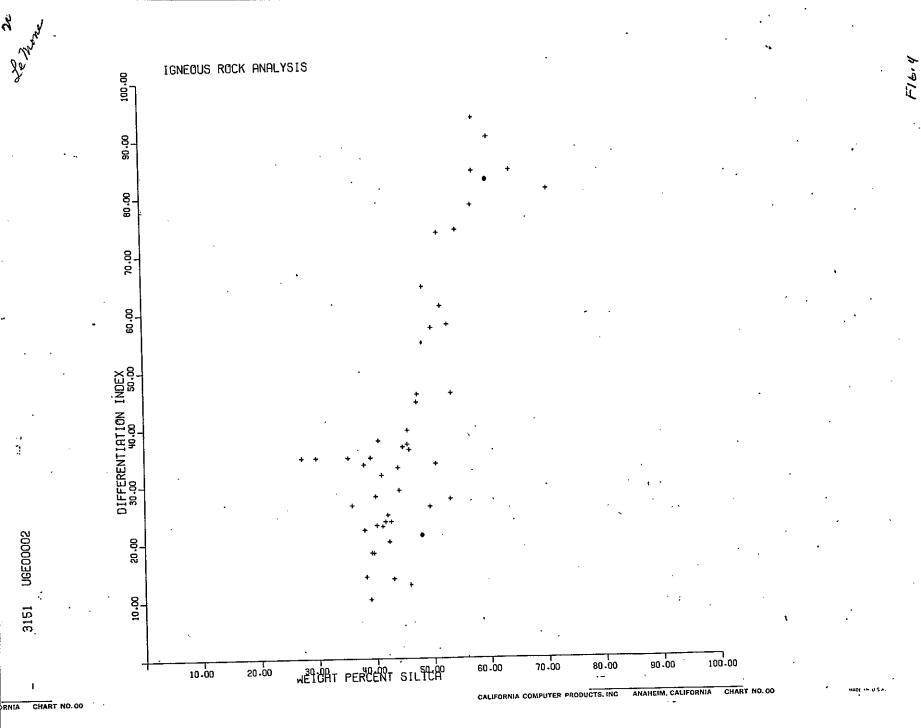
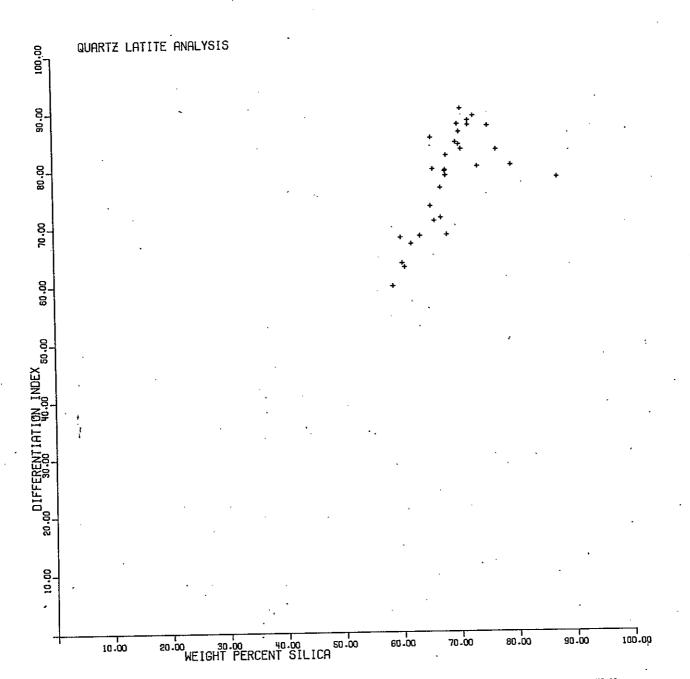


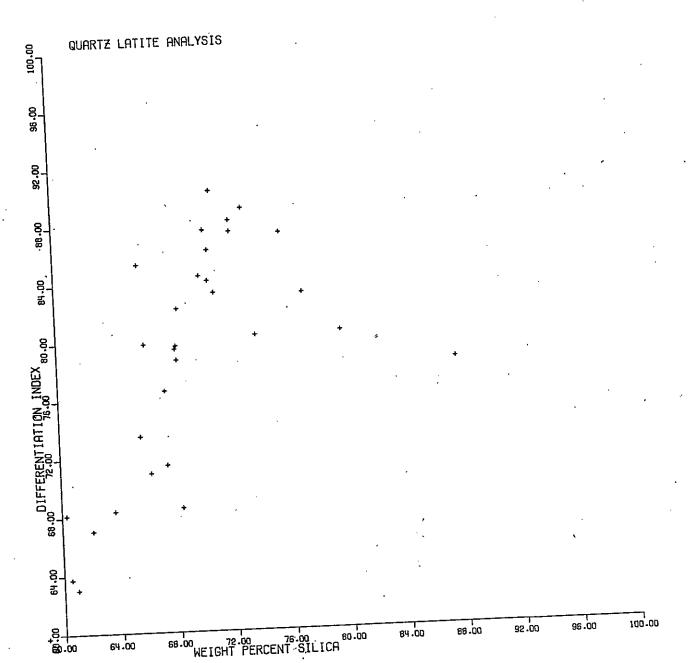
Figure 2 -- Program Rockdata.

13000 - 27 M









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Table 1 -- Mobil Research Oxide Analyses (courtesy R. Dennison for system test)

									
SiO ₂	1XX 54.77%	3XX 61.61%	4XX 57.75%	5XX 56.45%	6XX 52, 23%	7XX 61.03%	11XX 52.89%	13XX 67. 66%	14XX 58.90%
TiO ₂	1.02	0.57	0.95	0.61	0.65	0.90	1.32	0.48	0.88
Al ₂ O ₃	17.71	19.37	18.99	20.43	23.37	17.03	18.46	16.45	17.07
Fe ₂ O 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
NazO	4.00	4.61	5.10	6.25	4.61	4.23	4.43	4.50	4.79
K ₂ O	1.92	4.79	1.56	4.03	4.57	2.65	2.77	4.15	3.00
P2O5.	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
CO2	0.30	0.13	0.00	0.28	0.00	0.00	0.00	0.10	0.22
H ₂ O+	1.15	0.60	0.39	2.02	1.45	0.55	0.33	0.31	2.62
H ₂ O-	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 (WC)	6.324	
Diopside (EN)	4,627	•
Diopside (FS)	1.103	
Total Hypersthene	1.672	1.66
with the composition	ı	
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 Clivine	2.900	2.99
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

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      ORIGINAL CIPW CALCULATION PROGRAMMED FOR IBM MACHINE PENN. STATE UT
C
      BY CHARLES W. OMDRICK 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)
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      LE MONE AND ADAMS, UNIV. TEXAS EL PASO (1969)
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      PHASE 2. PLAGIOCLASE CALCULATION, UTEP, LE MONE AND ADAMS (1969)
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      PHASE 3, OLIVINE CALCULATION, UTEP, LE MONE (1969)
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      PHASE 4. CIPW CALCULATION TO VOLUME PERCENT CONVERSION
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      NAME=PLAGIOCLASE FELDSPAR MINERAL NAME
C
      ARRAY=ALPHAMUMERIC LABEL
C
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      Winter-Jordan and Famille For Chabbes ( 10 3 CARTIFICIAL SYSTEM)
C
      ZNAMF=JOHANNSEN FAMILIES FOR CLASS 4 (ARTIFICIAL SYSTEM)
C
      COMAME#JOHANNSEN CLASS AND ORDER
Č
      POMTABEPERCENTAGE OF ALBITE IN PLAGIOCLASE FELDSPAR
C
      PONTAN=PERCENTAGE OF AMORTHILE IN PLAGFOCLASE FELDSPAR
C
      POMIFO=PERCENTAGE OF FORSTERITE IN OLIVINE
C
      PONTER=PERCENTAGE OF FAYALITE IN OLIVINE
C
      DIFINX=DIFFERENTIATION INDEX
C
      COLIMX=COLOR INDEX
C
      TOTOURRETOTAL QUARFELOIDS
C
      TOTPYAM=TOTAL PYRIBOLES
C
      TOTORE = TOTAL ORE
C
      TOTAUX=TOTAL AUXILIARY CONSTITUENTS (CORUNDUM * APATITE)
      TOTIFC=TOTAL TEHCOCPATES (TOTOHAR + TOTAHY)
C
C
      TOIMFL=TOTAL MELOCRATES
                                (TUTPYAM + TOTULY + TOTORE)
C
      FOIDS=TOTAL FELSPATHOIDS
C
C
      DIMENSION NAME (5), ARRAY (10), NAMEOL (5),
     IMNAME (5), ZNAME (1), CONAME (5)
      REAL KEIKEPEAG
                *K+A+B+S102+T102+AL203+FE203+FE0+XMN0+XMG0+CA0+XNA20+XK2TE
     19,8205.0THER
   15 FORMAT(I3,2Al,7F10.5/5X,7F10.5)
      READ 16. ARRAY
   THE FORMAT (10AB) .
      $1021#$105
      11024=1102
```

AL2034=AL203

FE2031=FE203

FEON=FEO

XMMOA=XMMO

XMGOA=XMGO

```
(Table 3, continued)
       CAGA=CAG
       OSVNX=VUSVNX
                                                                                  7
       XK504=XK50
                                                                                  T
       P205A=P205
                                                                                  T
       LEMONE#1
                                                                                  T
       UTEP=1.0
                                                                                  Ţ
       IF (K-999)20
                        ,380
                                +380
                                                                                  T
    20 PRINTS5
                   , K , A . B
                                                                                  Ŧ
    25 FORMAT(1H1,6(/),49X,6HSAMPLE,13,2A1)
                                                                                  1
       IF(Sto2)30
                                                                                  Ţ,
                     • 30
                            • • 40
    20 PRINT 17, ARPAY
                                                                                  Ţ
    17 FORMAT (/,35X,1948)
                                                                                  T
       PRINT 35
                                                                                  T
   35 FORMAT(1H0,34X,37HTHIS SAMPLE CONTAINS NO SILICA)
                                                                                  T
       GO TO 375
                                                                                  ·T
   40 PRINTAS
                                                                                  Ţ
   45 FORMAT (1HO)34X)54HTHE CHEMICAL COMPOSITION OF THE ROCK IN WEIGHT PT
      1ERCENT)
       PRINTSO
   50 FORMAT(140,5%,4451u2,6%,44T102,5%,5HAL203,5%,5HFE203,7%,3HFE0,7%,3T
      1HMNO.74,3HMGO.74,3HCAO.6X,4HNA2O.7X,3HK2O.6X,4HP2O5,5X,5HOTHER)
                                                                                  T,
                   ,5102.[102.4L203,FE203,FE0,XMN0,XMG0,CA0,XNA20,XK20,P20T
      15,0THFR
                                                                                  T:
   55 FORMAT(1H ,4X,11(F6.3,4X),F5.3)
                                                                                  T.
       #SUM= (S102+T102+4L203+FE203+FE0+XMNO+XMG0+C40+XNA20+XK20+P205)
                                                                                  Ti
       PRINTSO
                   , ASUM
                                                                                  T:
   60 FORMAT (1H ,34X,3HSUM,23X,F7.3)
                                                                                  Ti
       PRINTSS
                                                                                  T
   65 FORMAT (140,49X,31H
                                                                   )
                               ÷
                                                                                  1:
0
             CALCULATION OF THE CATARARA HORS
                                                                                  Ţi
   70 AP=0.0
                                                                                  T
       メモレニりょり
                                                                                  T:
       SP=0.9
                                                                                  Ţ
       RU=0.0
                                                                                  Ŧ
       XKS=0.0
                                                                                  1

⟨KP=n.n.

                                                                                  T^{i}
       ALC≃a.a
                                                                                  Ţ
       OR=0.0
                                                                                  1
       XNS=0.0
                                                                                  73
       XNE=0.0
                                                                                  T
       A3=0.0
                                                                                  7 6
                                                                                  T
       AN=0.0
       C=0.0
                                                                                  T >
                                                                                  Ţ.
       AH 1 # 0 * 0
                                                                                  Ĭ.,
      HM=0.0
      Q=0.0
                                                                                  7
                                                                                  Ŧ
      0 = 0.0
       F0=0.0
                                                                                  育:
                                                                                  7.
      FA=0.0
                                                                                  73
      CS=0.0
      0 = 0.0
                                                                                  T
                                                                                  Ta
       40 = 0.0
       E⋈=0.0
                                                                                  Tá
                                                                                  T
       £S=0.0
                                                                                  T:
      riY=0.0
                                                                                  13
       0.0×0×0
                                                                                  T
       4C=0.0
C
      MOLECULAR PROPORTIONS CALCULATED
                                                                                  T
                                                                                  13
       ST02=ST02/60.09
                                                                                  T
       TJ02=TT02/79•90
                                                                                  T
      AL203=AL203/101.96
      FE203=FE203/159。?0
```

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(Table 3, continued)

```
FE0=FE0/71.85
      XMNO=YMM0/70.94
      XMC0=XMG0/40.32
      CA0=CA0/56.08
      XNA20=XNA20/61.982
      XK20=XK20/94.20
      P205=P205/141.950
      PRINT75
   75 FORMAT(1H0,45X,2)HMOLECULAR PROPORTIONS)
      PRINTAU
                ,STO2.TIO2.AL203.FE203.FE0.XMNO.XMG0.CA0.XNA20.XK20.P20T
   80 FORMAT (1H +4X+11 (F6.4+4X))
      FEQ#FEO+XMNO
C
      P205 TO APATITE
      AP=P>05
      CA0=CA0-3.3 *P205
      T102 TO ILMENITE. SPHENE. RUTILE
C
      IF (FFO-1102) 9a
                         ,85
   95 XIL=1102
      FEO=FFO-TIO2
      60 TO 105
   99 XII.=FFO
      1102=TIO2-FE0
      FEG#5.4
      IF (C40-TIO2) 100
                         • 95
                                ,95
   45 SP=TTO2
      CAO=CAO-TIO2
      50 To 105
  inn SP=CAN
      f[0047]02+C40
      CAO=a.a
      RU=Tin2
      K20 TO KALIOPHILITE AND POTASSIUM METASILICATE
 145 [F(AL203-XK20)]15 +110
                                  9110
  110 XKP=XKS0
      AL203=AL203-XK20
      GO TO 120
  115 XKP=AL203
      XK20=XK20-AL203
      4L203=0.0
     XKS=XK20
    . NAPO TO NEPHELINE. ACMITE, SODIUM METASILICATE
 120 IF(AL203-XNA20)130
                           .125
                                   ,125
  125 XNE=X 4A20
      AL203=AL203-XNA20
     .60 TO 145
 13n XME=4L203
      EUSTR-OSVNX=USVNX
      AL203=0.0
      IF (FE203-XNA20) 140
                            135
                                   ,135
 135 AC=X V420
     FE203=FE203-XN420
     GO TO 145
 140 AC=FE203
     XN420=XNA20-FF203
     FE203=0.0
      XNS=VNASO
     ALZOR TO ANORTHITE AND CORUNDUM
 145 IF (CAN-AL203) 155
                         ,155
```

150 AN=AL203

CAO=CAU-AL203

GO TO 160 ·

(Table 3, continued)

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155 AN=CAO
       AL203-CA0
       CAO=0.0
      C=4L203
      FE203 TO MAGNETITE, HEMATITE
  160 IF (FE203-FE0) 165
                         , 165
                                •170
  165 XMT#FF203
      FE0=FE0-FE203
      60 TO 175
  170 XMT=FFO:
      FE203=FE203-FE0
      FE0=0.0
      HM=FF2()3
      CAO. MGO. FEO TO OLIVINE. MONFICELLITE. CALCIUM ORTHOSILICATE
  175 KMGFF#XMGO+FEO
      RIAGEF=XMGO/XMGFE
       IF (XMGFE-CAO) 180
                           ,185
                                  ,185
  IGN XMO=YMGEE
      CAO=CAO-XMGFE
      .CS=C40
      60 To 190
  125 730=040
      XMGEF=XMGEF=CAU
      りしまXiaGEE
  190 SIO2=SIO2-SP-(2.0*XKP)-XKS-(2.0*XNE)-(4.0*AC)-XNS-(2.0*AN)-XMO-(CST
     1/2*0)*(0F/2*0)
      IF ($402) 195
                            ,205
                   ,270
  195 PRINT200
                 $5102
  200 FORMAT (THO, 29X, 52HNOT ENDUNGH SIOS TO FORM TEL UNDERSATURATED MINET
     1: ALO 1: X4748102 . 405.01
   CHECK PRINT CIRL. CHR.
      GO TO 375
  205 XXXKP=XKP#2.9
      IF (Stoz-XXXKP)216
                           .210
                                   .215
  210 KLC=STU2/2.0
     、スペピ=スペピースにひ
      60 TO 270
  215 KLC=XKP
      STO2=STO2=XXXKP
      XKP=0.0
      CCSS=CS/2.0
      1F(SIO2-CCSS)220 -,220
                                 +552
  20184 0.5=0% 055
      CS=CS-au
     1 GO TO 270
  225. #0=CS
      $102=$102-CC$$
      CS=0.0
      IF(SIO2-X40)230
                                ,235
                         .230
  230 01=5102
      SOT2-ONX=OMX
Ĭ,
      GO TO 270
  235 DI=X40
      SI02=SI02-X40
      人間()=0。()
      XXXLC=XLC#2.0
      IF(SIO2-XXXLC)240
                           ,240
                                   ,245
```

240 UB=SI02/2.0

245 OREXEC

XEC=XEC=OR

SIOS=SIOS-XXXFC

60 10 279

```
(Table 3, continued)
       XLC=0.0
       XXXNF=XNE#4.0
       IF (5102-XXXNE) 250
                              ,250
                                     , 255
  250 AB=S102/4.0
       XNE=XNE-AH
       GO TO 270
  255 AB=XNF
       SIO2=SIO2-XXXNE
       XNE=0.0
       XXXOL=OL/2.0
       IF (STO2-XXXOL) 260
                             ,260
                                     ·265
  260 HY=S[02#2.0
       OL=OL=9Y
       60 10 270
  265 HY=0L
                                                                                 · T
       SIO2=SIO2-XXXOL
                                                                                 Ŧ
                                                                                 T
      OL=0.0
      u=SIn>
                                                                                 7
C
      CONVERSION TO WEIGHT PERCENT
  270 R=1.0 -R4GFE
                                                                                 T.,
      CS#CS+XitO
                                                                                 Ŧ
                                                                                 Ţ.
       X400L=X40+0L
      FO=RMCFE#XMOOL
                                                                                 T
      FA=R*X400L
                                                                                 Ti
      EN=HY#RMGFE
                                                                                 T
      FS=HY#R
                                                                                 1
      Olwo-blal.o
                                                                                 T
      DIEN=DI#RMGFE
                                                                                 Ť
      UIFS=oI⇒≺
                                                                                 7
      40444-325334
      RU#RU#79.90
                                                                                 T.
      C=C*[0].96
                                                                                 Ţ,
      U=0*60.09
                                                                                 Т.:
      XKP=YKP#316.34
                                                                                 T_{2}
      XLC=XLC#436.52
                                                                                 Ti
      OP≈99≈556.70
                                                                                 Ti
      CS=CS#86+125
                                                                                 1:
      90=90#116.17
                                                                                 Ŧä
      XNE=X-164284.122
                                                                                 ΤĿ
      AB=03#524.492
                                                                                 Ţű
      FA=FA#101.895
                                                                                 Ţŗ
      FO=F0#70.365
                                                                                 4 ?
      EN=FN#100-41
                                                                                 7:
      FS=FS#131.94
                                                                                 T:
      HM=HM#159.70
                                                                                 Tŵ
      XMT=X:11#231.55
                                                                                 Tt
      AN=AN#278.22.
                                                                                 Ti
      XKS=XK5*154.29
                                                                                 T.f
      XNS=XNS*122.07
                                                                                 Tã
      SP=SP*196.07
                                                                                 70
      XIL=XIL*151.75
                                                                                 T:
      AC=AC#462.042
                                                                                 ΤÆ
                                                                                 T
      DIWO=01w0*116.17
      DIENHOLEN#100.41
                                                                                 T
      DIFS=DIFS*131.94
                                                                                 TÆ
      UL=F:)+F4+CS
                                                                                 Ti
      DI=DT=0+D[EN+DIFS
                                                                                 ΤĒ
      HY=EV+ES
                                                                                 TŦ
      DIFINX=OR+AB+C+XME+XKP+XLC
                                                                                 TE
      COLINX=!) L+HY+OL+X4T+XIL+AP
                                                                                 Τë
      ASUM=(AP+XIL+SP+RU+XKP+XKS+XNE+AC+XNS+AN+C+XMT+HM+FA+CS+F0+XLC+W0+TE
     JEN+OR+AH+FS+Q+DI40+0IEN+DIFS)
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(Table 3, continued)
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PRINT275
 275 FOPMAT (1HO, 29X, 32HC. I.P. W. NORM (IN WEIGHT PERCENT))
                    AΡ
                               •DIFINX
 277 PRINT 280+
 2RO FORMAT (1H .34x, THAPATITE, 19X, F7.3, 2UX, 21HDIFFERENTIATION INDEX, 10X
     1,F7.3)
                               .COLINX
      PRINT285
                  , XIL
 285 FORMAT (1H , 34x + 8HILMENITE , 18X , F7 - 3 , 20X , 11HCOLOR INDEX + 20X8F7 - 3)
      PRINTAGO
                  ·SP
 290 FORMAT (1H +34X+6HSPHENE+20X+F7+3)
                  , 411
      PRINT295
 295 FORMAT (IH +34×+6HRUTILE+21×+F7+3)
      PRINT300

    XKS

  340 FORMAT (1H, 34X, 144K-METASILICATE, 12X, F7.3)
      PRINTAN5
                  · XKP
  345 FORMAT(1H ,34Y,13HK4LIOPHILLITE,13X,F7.3)
      PRINT310
                  . XLC
  310 FOPMAT (14 .34x,7-LEUCITE,19X,F7.3)
      PRIMINE
                  • 0P
  315 FORMAT(1H 34X, 10HORTHOCLASE, 16X, F7.3)
      PRINTAZO
                  · XMS
 329 FORMAT (14 , 34x, 15HNA-METASTLICATE, 11X, FY. 3)
      PPINT325
                  *XWE
      PABAN = AB/524.482 + AN/278.22
      IF (PARAN.GT.O.O)
     1PCNTAB = ((AB/524.482)/PABAN) # 100.
      IF (24844.GT.0.0)
     1PCMIA1 = ((AM/279.22)/PABA1) * 100.
      IF (PC 11A3.GE.90.0) ENCODE (20,490,NAME)
      IF (PCMTA 3.LT.40.0) ENCODE (20,480.NAME)
      1) (20-17 AS. LI. 70.0) ENCODE (20,460, NAME)
      IF (PCHTA3.LT.SO.D) ENCODE (20,440, NAME)
      IF (PCHTAB.LT.30.0) ENCODE (20,420,NAME)
      IF (PONTAB.LT. 10.0) ENCODE (20.410.NAME)
      PEOFA = FO/70.365 + FA/101.895
     .1F (0F0FA.GT.0.0)
     'IPCNITED = ((FO/70.365)/PFOFA) * 100.
      IF (PFOFA.GI.().0)
     1PCNTFA = ((FA/101.895)/PF0FA) * 100.
         (PC VIFO.GE.90.0) ENCODE (20,590, NAMEUL)
         (PCNIFO.LT.90.0) ENCODE (20,580,NAMEOL)
         (PCNIFO.LI.70.0) ENCODE (20,560,NAMEUL)
      IF (POIFFO.LT.50.0) ENCODE (20.540.NAMEUL)
         (20,520, TAMED) ENCODE (20,520, TAMEDL)
      IF (PONIFO-LT-10-0) ENCODE (20,510, NAMEOL)
  325 FORMAT (1H , 34 x , 9 HNEPHELINE , 17 X , F7 - 3)
      PRINT330
                   , AB
  330 FORMAT(1H ,34X,6HALBITE,20X,F7.3)
                   , AN
      PRIME335
  335 FORMATCIH , 34x, 9HANORTHITE, 17X, F7.3)
      PRINT340
                   • C
  34n FORMAT (1d ,34X,8HCORUNDUM, 18X,F7.3)
                   • XINT
      PRINT345
1.
  345 FORMAT (1H , 34X, 9HMAGNETITE, 17X, F7.3)
      PRIMI350
                   · Hit
  350 FORMAT(11 +34X+8HHEMATITE+18X+F7+3)
                   , ()
      PRINT355
  355 FORMAT (14 +34X+64QUARTZ+20X+87+3)
      PRINT360
                   +OL+FO+FA+CS
  360 FORMAT (1H +34X+13HTOTAL OLIVINE, 13X+F7-3, 22H WITH THE COMPOSITION T
     1,/40x,10dFORS[ERI[E,1]x,F7.3/40X,8HFAYALITE.13X,F7.3/40X,16HCA-ORTT
     2HOSTLICATE, 5X, F7.3)
                   DI DINO, DIEN, DIFS, HY, EN, FS, NO, AC
       PRIMIAAS
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(Table 3, continued)
  365 FORMATCIH +34×+14HTOTAL DIOPSIDE+12X+F7+3+22H WITH THE COMPOSITIONT
      1,/40x,13HDIOPSIDE (40),8X,F7.3/40X,13HDIOPSIDE (EN),8X,F7.3/40X,13T
      2HDIOPSIDE (FS), SX, F7.3/35X, 17HTOTAL HYPERSTHENE, 9X, F7.3, 20HWITH TT
      3HE COMPOSITION/40X, 9HENSTATITE, 12X, F7.3/40X, 12HFERROSILLITE, 9X, F7T
      4.3/35X,12HWOLLASTONITE,14X,F7.3/35X,6HACMITE,20X,F7.3)
                   • ASUM
       PRIMITION
                                                                                T
  370 FORMAT(1H ,34X,3HSUM,23X,F7.3)
                                                                                T
       PRINT65
                                                                                T
       IF (PABAN.GE.O.OO1)
                                                                                T
     IPRINT 470. NAME, PONTAB, PONTAN
                                                                                T
       IF (PFOFA.GE.0.001)
                                                                                T
      IPRINE 570. NAMEDL. PCNTFO, PCNTFA
                                                                                T.
  375 CONTINUE
                                                                                Ţ
       IF (LEMONE.GE.2) GO TO 610
      LEMONE = LEMONE + 1 -
                                                                                T
      UTER=100.0/ASUN
                                                                                T
      PRIME SOAK+A+B
                                                                               T
      PRINT 17, ARRAY
                                                                               T
   26 FORMAT (141.6(/).44X.7HSAMPLE.13.241.8H + FUDGE
                                                                               Ţ.,
      SIOPESIOZARUTEP
                                                                               T
       1105=1105Vantes
                                                                               T
      AURO3=AURO34#UTEP
                                                                               Ţ.
      FE203=FE203A#UTEP
                                                                               T
      FEO=FEOA*UTEP
                                                                                Τ÷
      XMM()=XMMOA#HTFP
                                                                               Tā
      XMGO=XMGOA#UTEP
                                                                               Τŝ
      CAD=CADA*UTEP
                                                                               Τű
      XNA20=XNA20A@UTEP
                                                                               Tμ
      XK20=XK20A#UTFP
                                                                               Ti
      المريقة المحاشدة والمرسط والمراتع
                                                                               Ĩ:
      OTHER=0.0
                                                                               Ti
      IF (STOR) 30,30,40
                                                                               Τž
      FORMAT (20H AMORTHITE
410
                                                                               Τį
420
      FORMAT (20H BYTE) WHITE
                                                                               T#
      FORMAT (20H LABRADURITE
440
                                                                               Tä
450
      FORMAT (20H AMDESINE
                                                                               Ti
      FORMAT (50% 20HPLAGIOCLASE FELDSPAR/50%, 544/50%, 4H( AB, F7.3, 3H AN, TE
470
     ) F7.3,24 ) )
                                                                               Tř
      FORMAT (21H OLIGOCLASE
440
                                                                               Te
490
      FORMAT (20H ALBITE
                                        )
                                                                               Tä
  510 FORMAT (20H FAYALTTE.
                                                                               Τį
  520 FORMAT (20H FEPROHORTONOLITE
                                                                               Τē
  540 FORMAT (23H HORTOHOLITE . .
                                                                               Tž
  560 FORMAT (20H HYALOSIDERITE
                                                                               T:
  570 FORMAT (50X, THOLIVINE/50X, 5A4/50X, 4H( FO, F7.3, 3H FA, F7.3, 2H) )
                                                                               TS
  580 FORMAT (20H CHRYSOLITE
                                                                               Tŧ
  590 FORMAT (20 H FORSTERITE
                                                                               TE
  610 CONTINUE
                                                                               Tî
      IF (LEMUNE.GE.3) 60 TO 620
                                                                               Τ÷
      LEMONE=LEMONE + 1
                                                                               Τ÷
      VAP=AP/3.189
                                                                               TF
      VRU=RU/4.250
                                                                               TΞ
      VC=C/3.958
                                                                               TE
      V0=0/2.649
                                                                               ΤE
      AXK6=AKH\5.910
                                                                               ΤE
      VXLC=XLC/2.480
                                                                               Ta
      VOR=0R/2.551
                                                                               ΤĒ
      .VCS=CS/2.4938
                                                                               TE
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T:

V#0=#072.989

VAB=48/2.617

VEA=FAZ4,393

VXNE=XME/2.623

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(Table 3, continued)
     VF0=F0/3.214
     VEN=FN/3-198
     VFS=FS/3.5
    - VHM#H41/5•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
     ADIMU=0140\5.408
     VDIEN=DIEN/3.198
     VDIFS=DIFS/3.500
     VHY=VFN+VFS
     VDI=VDIWO+VDIFM+VDIFS
     VOL=VFA+VFO+VCS
     ADILIJX=AO+AXKb+APH+AOB+AXJE+AXFC
     ACOFTHX=ADI+AHX+AOF+AXW1+AXIF+AVB
     VASUM=(VAP+VXIL+VSP+VHU+VXKP+VXKS+VXNE+VAC+VXMS+VAN+VC+VXMI+VHM+VFI
    14+VCS
              +VCS+YFO+VXLC+VWO+VEN+VOR+VAB+VFS+VQ+VD1WO+VD1EN+VD1FS)
     ADaMS=100.0/VASUA
     VDIFSA=VOIFS*ADAMS
     VAPBEVAPRADAMS
     VOIENREVOIENRADAMS
     VDIFS (=VD)FS#ADAMS
     VRUB=VRUMADAMS
     VCH=VC#ADAMS
     VOR=VO#ADAMS
     48 (2015) (2014) (2018)
     VXLCH=VXLCHADAMS
    VORB=VORMADAMS
    VCSH=VCSMADAMS
    VXNFA=VXNF#ADAMS
    VARB=VARTADAMS
    VFAB=YFA#ADAMS
    VFQB=VFO*404MS
    VENB-VENGADAMS
    VESB=VES#ADAMS
    VHMB=VHY*ADAMS
    VXMT3=VX31*ADAMS
    VANH=VAN#ADAMS
    VXNSH=VXNSRADAMS
    VXIISB=VXNS*ADAMS
    VSPB=VSP*ADAMS
    VXJLA=VXIL*ADAMS
    VACB=VAC*ADAMS
    SMADA # CHICALON TO A SCIMILON
    VHYB=VHY#ADAMS
    VDIB=VDI#ADAMS
    VOLB=VUL#ADAMS
    VDIF [NXB=VD[F]NX*ADAMS
    VCOLIMXB=VCOLINX#ADAMS
    VASUMR=VASJM#ADAMS
611 CONTINUE
    PRINT 27, K, A, A
 27 FORMAT (1H1.6(/).49X.6HSAMPLE.14.2A1./.49X.34HCALCULATED C.I.P.W.
   I VOLUME PERCENT)
    PRINT 17. ARRAY
    YEANABH
    DIENEVOTENE
```

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(Table 3, continued)
      DIFS=VOIFSB
      RU=VRU3
      C=VCA
      (J=V)3
      メベトニ ハメベレリ
      Xrc=Axrc9
      UR=VORB
      CS=VCS3
      WO=VWOB
      XNE=VXNE9
      48=V4B3
      FA=VFAB
      FO=VFOA
      EN=VENA
      FS=VFS4
      HM=VH 43
      XMT=VX4T3
      VILVA - NY
      XKS=VXKS3
      XNS=VYNSB
      SP=V5177
      XIL=VXIL3
      AC=VAC3
      FOR LUNCONIO
      HY = V + Y + 1
      DI=VDIA
      OL≃VOL4
      DIFINX=ADIEINX9
      COLINX=ACOFINXB
    . ASU~≃∀ASumu
      GO TO 277
 520 CONTINUE
      IF (LEMOTE.GE.4) GO TO 10
      LEMONE=LEMONE + 1
      リリニマの中
      KF=VOR3
      PLAG=VARS+VANB
      FOIDS=VXNEG+VXLCG+VXKPA
      TOTOGAR=Qd+KF+PLAG+FOIDS
      TOTPYAM=VSP3 + VAC3 + VXNS3 + VXKS3 + VD18 + VHYB + VWO3
      FJOV=VJO101
      TOTORFEVANTS + VXILB + VHMR + VRUB
      TOTABLE VC3 + VAPR
      INTLEC=[U]QUAP + TOTAUX
      TOTMAF=TOTPYAM + TOTOLV + TOTORE
      TOTMEL=TOIMOF
    · IF (PLAG.GT.0.0)
     1PCNTVAB=VABB/PLAG * 100.
      IF (FOTMAF.GT.O.O)
     1PCMTORE=TOTORE/TOTMAF * 100.
r 海7所以F(ff)TLEC.LT. 5.0) GO TO 930 🗽
  1 1 IF (TOTLEC.LT.50.0) GO TO 920
      IF (TOTLEC.LT.95.0) GO TO 910
 960 JE(TOTLEC.GE.95.0) 60 TO 900
 900 IF (PONTVAR.GE.90.0) ENCODE (20,901, CONAME)
      IF (PCNTVAB.LT.90.0) ENCODE (20,902, CONAME)
      IF (PCATVAR.LI.50.0) ENCODE (20,903, CONAME)
      IF (PONTVARILITION) ENCODE (20,004, CONAME)
      GO TO 975
 910 IF (PCNTVA9.GE.90.0) ENCODE (20,911, CONAME)
```

IF (PCMTVAR.LT.90.0) ENCODE (20,912, CONAME)

IF(PCVTVAB.LT.50.0) ENCODE (20,913,CONAME)

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(Table 3, continued)
      IF (PCNTVA3.LT.10.0) ENCODE (20,914, CONAME)
      60 TO 975
 920 IF (PCMTVAB.GE.90.0) ENCODE (20,921,CONAME)
      IF (PCHTVAR.LT.90.0) ENCODE (20,922,CONAME)
      IF (PCMTVAB.LT.50.0) ENCODE (20.923, CONAME)
      IF (PCNTVAB.LT.10.0) ENCODE (20,924, CONAME)
      60 to 975
 930 IF (PCNTORE.GE.90.0) ENCODE (20.931, CONAME)
      IF (PONTORE.LT.90.0) ENCODE (20,932,CONAME)
      IF (PCHTORE.LT.50.0) ENCODE (20,933, CONAME)
      IF (PCNTORE.LT.10.0) ENCODE (20,934, CONAME)
                   CLASS 1
                             ORDER 1
 901 FORMAT (20H
 HOS) TAMBOR SOF
                   CLASS 1
                             ORDER 2
                                       )
 903 FORMAT (20H
                   CLASS 1
                             ORDER 3
                                       )
 904 FORMAT (20H
                   CLASS 1
                             URDER 4
 31) FORMAT (20H
                   CLASS 2
                             ORDER 1
 912 FORMA: (20H
                   CLASS 2
                             ORDER 2
 913 FORMAT (2)H
                   CLASS 2
                             ORDER 3
 914 FORMAT (20H
                   CLASS .2
                             ORDER 4
                                       ).
 921 FORMAT (27H
                  CLASS 3
                             ORDER 1
                                       }
 322 FORMAT (23d
                  CLASS 3
                             ORDER 2
 923 FORMAT (23H
                   CLASS 3
                             ORDFA 3
                   CLASS 3
 924 FORMAT (20H
                             ORDER 4
 931 FOPMAT (20H
                   CLASS 4
                             ORDER 1
                                       )
 932 FORMAT (20H
                   CLASS 4
                             ORDER 2
                                       )
 933 FORBAT (25H
                   CLASS 4
                             ORDER 3
                                       )
 934 FORMIT (23H
                             ORDER 4
                   CLASS 4
      (F(IOTHAF .GI.O.O)
     12CNTOLV=f0f0LV/f0f44F * 100.
      18 (40 HOLV. (8.45.45)
                             ENUMBER (28 ) 971 , ZNAME)
                             ENCODE (28 ,972, ZNAME)
      IF (PCMIHLV.LT.95.0)
                             ENCODE (28 .973, ZNAME)
      IF (PONTOLV.LT.50.0)
      IF (PCMTOLV.LT. 5.0)
                             ENCODE (28 ,974,ZNAME)
      GO TO 621
 971 FORMAT(23H FAMILY O
                                                )
 972 FORMAT (28H FAMILIES 1,2,3,4
 973 FURMAT (284 FAMILIES 5,6,7,8
 974 FURMAT (28H FAM(LIES 9,10,11,12
 975 0UF0IDS=QU+F0IDS
      ENCODE (SH'SUOD'SAVWE)
2000 FORMAT (28X)
      KEPLAG= KE+PLAG
      JF (KFPLAG,GI,0,0)
     IPCNIKE= KEZKEPLAG*IOO.
      IF (QU.EQ.0.0) GO TO 977
        (foldaragen.o)
  ... IPCMTqU=QU/TOTQUAR*LOO.
     IF (PONTAJ.LT. 5.0) GO TO 830
     ## (PCNTQU.LT.50.0) 60 TO 820
     "IF (PCMTQU.LT.95.0) GO TO 810
    LIF (PONTAU.GE.95.0) ENCODE (20.800, MNAME)
(学97年) [除了(FOIDS-E0-0-0) GO TO 621
      IF (TOTQUAR.G1.0.0)
     JPCMTFD=F0ID5/T0TQUAR#100.
      IF (PONTED-LT. 5.0) 60 TO 840
      IF (PCMTFD.LT.50.0) 60 TO 850
      IF (PCMTFD.LT.95.0) GO 10 860
      LF (PONTED . GE. 95.0) ENCODE (20, 970, MNAME)
 810 IF (ACNTRE.GE.95.0) ENCODE (20,816,MNAME)
         (PONTKE LI.95.0) ENCODE (20,817,MNAME)
        (PONTKE.LI.50.9) ENCODE (20.818, MNAME)
         (PCNIKE .LI. 5.0) ENCODE (20.819, MNAME)
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(Table 3, continued)
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GO TO 521
          (PCNTKF.GE.95.0) ENCODE (20,826, MNAME)
   820 IF
          (PCNTKF.LI.95.0) ENCODE (20,827, MNAME)
          (PCNTKF.LT.50.0) ENCODE (20,828,MNAME)
       IF (PCNTKF.LI. 5.0) ENCODE (20,829, MNAME)
       GO TO 521
   830 IF (PCNTKF.GE.95.0) ENCODE (20,836,MNAME)
       IF (PCNTKF.LT.95.0) ENCODE
                                   (20.837.MNAME)
       ĬF
         (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
                                  (20,845,MNAME)
          (PCNTKF.LT.95.0) ENCODE
                                  (20.847.MNAME)
       IF (PCNIKF.LT.50.0) ENCODE (20.848, MNAME)
          (PCVIKE.LT. 5.0) ENCODE
                                   (20,849,MNAME)
       GO TO 521
  850 IF
         (PCNTKF.GE.95.0) ENCODE
                                  (20,856,4NAME)
          (PCNTKF.LT.95.4) ENCODE
                                   (20,857,MNAME)
          (PCMTKF.LT.50.0) ENCODE
                                  (20,858,MNAME)
          (PCNIKE.LT. 5.0) ENCODE
       IF
                                   (20,859,4NAME)
       GO TO 421
  860 IF
         (PC ITKE .GE .95.0) ENCODE
                                   (21,866,MNAME)
       IF
         (PCNTKF.LT.95.0) ENCODE (20,867, MNAME)
       IF
         (PCMTKF.LT.50.0) ENCODE (20.868, MNAME)
         (PONTAFILT, 5.4) ENCODE (20,869, MNAME)
  BOO FORMAT (SOHEAMILY D
  BIB FORMAT
             (SUHFAMILY
  BIT FORMAT
             (2045VMIFA
                          5
  BIR FORMAT (29HFAMILY
                          3
  ALO FORMS
             CARMENULLY
  826 FORMAT (SUHFAMILY
  827 FORMAT (20HEAMILY
  BER FORMAT (SOHFAMILY
  829 FORMAT (20HEAMILY
                          Q
  836 FORMAL (20HEANILY
  BRY FORMAT (20HFAMILY 10
  339 FORMAT (ZOHEAMILY 11
  839 FORMAT (2) HEAMILY 12
  BAS FORMAT (20HFAMILY 13
  847 FORMAT (20HEAMILY 14
  BAR FORMAT (20HFAMILY 15
  849 FORMAT (2"HEAMILY 16
  856 FORMAT (ZOHFAMILY 17
  857 FORMAT (2. MFAMILY IR
             (20HEAMILY 19
  858 FORMAT
  859 FORMAT (274FAMILY 20
  866 FORMAT (20HFAMILY 21
  SS YJIMAT (2) HEAMILY 22
  869 FORMAT (ZOHFAMILY 23
  869 FORMAT (20HFAMILY 24
...870 FORMAT (20HFAMILY 25
17:621
     CONTINUE
                                                         COULTABE
      PRINT 37.4.A.B
  37 FORMAT (1H1,49X+5HSAMPLE+14,2A1,/,49X,25HJOH/NNSEN
                                                           CLASSIFICATION
     ] 1///)
      PRINT 17, ARRAY
     PRINT
           1010
1010 FORMAT (30%,)4H1. QUARFELOIDS)
     FIRE TOSUS
                  VQB
1020 FORMAT (34X,14HA. (QU) QUARTZ,18X,F7.3)
     PRINT 1030.
                  VQR3
1030 FORMAT (34X,18HB. (KF) ORTHOCLASE,14X,F7.3)
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(Table 3, continued)
       PRINT 1040.
                    VARB
 1040 FURMAT (34x, 174C.
                           (VABB) ALBITE, 15X, F7.3)
       PRINT 1050, VANS
 1050 FORMAT (42X,11H+ ANORTHITE,13X,F7.3)
       PRINT 1050. PLAG
                                                                             T T T
 1060 FORMAT (37x.17HTOTAL PLAGIOCLASE, 12X, F7.3)
       PRINT 1070. VXNEB
 1070 FORMAT (34X.20HD. (VXNEB) NEPHELINE, 12X, F7.3)
       PRINT 1030, VXLCB
                                                                             T T T
 1080 FOPMAT (45X.9H+ LEUCTTE, 12X, F7.3)
       PRINT 1090. VXKPB
 1090 FORMAT (45X, 15H+ KALTOPHYLLITE, 6X, F7.3)
       PRINT 1100. FOIDS
                                                                             ſ
 1100 FORMAT (37X, 18HTOTAL FELSPATHOIDS, 11X, F7.3)
       PRINT 1110, TOTQUAR
                                                                             T
 (11) POPMAT(33x,27HTOTAL GUARFELOIDS (TOTQUAR).6x,F7.30%
                                                                            T
      SSIL INIAA
                                                                             T
 1120 FORMAT (30X, JOH?. MAFITES)
                                                                            , T
      PRINT 1130
                                                                             Ţ.
 1136 FORMAT (34X+11HA, PYHIBOLES)
                                                                             T
       PRINT 1140 , VSP3
                                                                             T
                                                                             T
 1140 FORMAT (39X, 6HSPHENE, 2)X, F7.3)
       PRINT 1150. VACS
                                                                             ŗ
 1150 FORMAT (37x,8H+ ACMITE,21x,F7.3)
                                                                           , Ţ:
                                                                             T
      PRINT 1160. VXMSB
 1160 FORMAT (37X,22H+ SODIUM METASILICATES,7X,F7.3)
                                                                             Tr
                                                                             T
      PRINT 1170, VXKS8
                                                                             T
 1170 FORMAT (37x,22H+ POTASH METASILICATES,7x,F7.3)
      PRINT 1180, VDIA
                                                                             Ţí
 1150 FURMAL (3/6,1004 UliPSIDE,19Ar7.3)
                                                                             Ţ:
                                                                             1:
      PRIMI 1190. VHYS
                                                                             Ŧ
 1190 FORMAT (37x. 13H. HYPERSTHENE, 16x, F7.3)
      PRINT 1200, VWO3
                                                                             T
                                                                             Ţ٤
 1200 FORMAT (37X, 14H+ VOLLASTONITE, 15X, F7.3)
      PRINT 1210. TOTPYAM
                                                                             Ţ,
                            (TOTPYAM), 14X, F7.3)
 1210 FORMAT (35X+16HTOTAL
                                                                             1:
                                                                             Ţ;
      PRINT 1820
 1220 FORMAT (34X, 10HB, OLIVINE)
                                                                             Ŧŧ
      PRINT 1221. VFOG
                                                                             Tf
 1221 FORMAT (39X.10HFORSTERITE, 17X, F7.3)
                                                                             T:
                                                                            : T:
      PRINT 1222, VFAB
 1222 FORMAT (39K, 8HFAYALITE, 19K, F7.3)
                                                                            : Ti
      BBINL 15534 ACCT
 1223 FORMAT (39X, 16HCA UNTHOSILICATE, 11X, F7.3)
      PRINT 1230, VOLB
 1230 FORMAT 1036%, 14HTOTAL OLIVINE, 16X, F7.3, //)
                                                           To a talled a latter to
      PRINT 1240
                                                          P3111 174 5
 1240 FORMAT (34X, 7HC, ORES)
                                                          100000 (1235/10(2012
      PRINT 1259, VXMTB
                                                            1 1 12 . .
                                                                        1250 FORMAT (39X,9HMAGNETITE,18X,F7.3)
                                                          16361 120 .
      PRINT 1260, VXILB
                                                                        マス・こ 子:
                                                    TIRE JIHR CUIT WITH PRINCE
· 11260, FORMAT, 3039X, 8HILMENITE, 19X, F7.3)
      PRINT 1270: VHMB
                                                                             TE
 1270 FORMAT (39x, SHHEMATITE, 19x, F7.3)
      PRINT 1280, VRU3
                                                                             Τį
 1280 FORMAT (39X,6HRUTILE,2]X,F7.3)
                                                                             13
      PRINT 1290, TOTORE
 1290 FOPMAT (37X+18HTOTAL ORE (TOTORE)+11X+F7+3+//)
                                                                             T
      PRIMT 1300
                                                                             T.
 1300 FORMAT (30%, 25H3. AUXILIARY CONSTITUENTS)
```

7:

PRINT 1310, VCB

1310 FORMAT (39%, AHCORUNDUM, 19%, F7.3)

```
PRINT 1320: VAP3
```

1320 FORMAT (39X.7HAPATITE.20X.F7.3)

PRINT 1330 + TOTAUX

1330 FORMAT (37X.24HTOTAL AUXILIARY (TOTAUX),5X,F7.3,//) PRINT 1340, TOTLEC

1340 FORMAT (50X, 11HLEUCOCRATES, 18X, F7.3) PRINT 1350, TOTMEL

1350 FORMAT (50X, 10HMELOCRATES, 19X, F7.3, ///) PRINT 1360, CONAME

1360 FORMAT(40X,6HCONAME,14X,5A4)

PRINT 1370, MNAME 1370 FORMAT (40X+5HMNAME+)5X+5A4)

PRINT 1380. TNAME 1390 FORMAT (4)X,5HZNAME,15X,7A4) GO TO 520

384 END.

FORTRAM DIAGNOSTIC RESULTS FOR ROCKDATA

NULL STATEMENT NUMBERS

970

211

70

LOAD,56 RUN , 10 , N.A.

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.

*K • A • B • SIO2 • TIO2 • AL203 • FE203 • FE0 • X 4NO • XMGO • CAO • XNA20 • XK2PI

C UNIV. TEXAS FL PAST. LEMONE (1969) C PHASE 7, COLOR INDEX CALCULATION (COLINX) C UNIV. TEXAS EL PASO. LEMONE (1969)

C PHASE A. SURROUTINE SUBPLOT, MULTIPLE AND SINGLE C! UNIV. TEXAS EL PASO. LEMONE (1969) C

NAME = PLAGIOCLASE FELDSPAR MINERAL NAME C ARRAY=ALPHANUMERIC LABEL C NAME OF THE OF INTERAL NAME C ATT A SUCHANOS, PRANTER FOR CENSULS (10 3 (PRITEICIAL SYSTEM) C INAME = JUHANNSEN FAMILIES FOR CLASS 4 (ARTIFICIAL SYSTEM)

C COMAME=JOHANNSEN CLASS AND ORDER C PONTAR-PERCENTAGE OF ALBITE IN PLAGIOCLASE FELDSPAR C PCHTAN=PERCENTAGE OF AMORTHITE IN PLAGIOCLASE FELDSPAR

C PONTED=PERCENTAGE OF FORSTERITE IN OLIVING : C PCMIF Y=PERCENTAGE OF FAYALITE IN OLIVINE C DIFINX#DIFFERENTIATION INDEX C COLIMY=COLOR INDEX

C TOTOUAR=FORAL QUARFELOIDS C TOTPYAM=TOTAL PYRIBOLES C TOTORF=TUTAL ORE

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C TOTAUX=FOTAL AUXILIARY CONSTITUENTS (CORUNDUM + APATITE) C TOTLEC=TOTAL LEUCOCRATES (TOTAGAR + TOTAGA)

С * TOIMEL = FOTAL MELOCRATES (TOTPYAM + TOTOLV : TOTORE)

C : FOIDS=TOTAL FELSPATHOIDS C

DIMENSION NAME (5) . ARPAY (10) , NAMEOL (5) , 1MNAME (5) , ZNAME (7) , CONAME (5)

REAL KEAKEPLAG

COMMON ODIFINX (1000) , SSIO2 (1000) , NPTS

1. REWIND 49 REWIND 10

NPTS=0

10,P205,0THER

15 FORMAT(13.2A1.7F10.5/5×.7F10.5) READ IS ARRAY

16 FOPMAT (10A8)

2015-1-2015 11023#1102 AL2030=AL203

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(Table 4, continued)
       FE2034#FE203
       FEUA=FEO
       NMMO 4=XMMO
       XMGOA=XMGO
       CAOA=CAO
       OSANX=ANSANX
       XK507=XK50
       P205A=P205
      LEMONE=1
      UTEP=1.0
       IF (K=999)20
                       ,380
                              ,380
   20 CONTINUE
C
   20 PRINTS
                   ,K,A,3
   25 FORMAT(1H1,6(/),49%,6HSAMPLE,13,2A1)
       IF (S102) 30
                      +30
   39 CONTINUE
   30 PRINT 17. ARRAY
C
   17 FORMAT (/, 35X, 10A8)
C
      PRINT 35
   35 FOPMAT (140, 34x, 30HTHIS SAMPLE CONTAINS NO SILICA)
      60 10 375
   40 CONTINUE
C
   40 PRINTAS
   45 FORMATICE +34X+54HTHE CHEMICAL COMPOSITION OF THE ROCK IN WEIGHT PR
     1 ERCF MT1
C
      PRIMISH
   50 FORMAT(1H0,5%,4HST02,6%,4HTT02,5%,5HAL203,5%,5HFE203,7%,3HFE0,7%,3P
     1HMNO.7X.3HMGO.7X.3HCAO.6X.4HNA2O.7X.3HK2O.6X.4HP2O5.5X.5HOTHER)
C
     15 • OTHER
C
                  9510247102 14L2 19976200 48 LU9 ABRO 4 ABU9 CAU9 XNAZU9 AKZU9 PZOH
      2872755
   55 FORMAT(14 ,1X,11(F5.3,4X),F5.3)
      BSUM=(SIO2+T102+4L203+FE203+FE0+XMN0+XMG0+C40+XNA20+XK20+P205)
C
      69111119
                  . ASUY
   60 FORMAT(14 ,34X,3ASUM,23X,F7.3)
C
      PRINTS
   65 FOPMAT() HO, 49X+31H
                           , %
             CALCULATION OF THE C.I.P.W.
С
                                           NORM
   70 AP=0.0
      XIL=n.a
      SP=0.0
      早り=り。り
      XKS=0.0
      XYP=n.9
     -XLC=0.0
      1)R=0.0
      XNS=0.0 -
      XNF=0.0
      AB=0.0 .
      AN=0.0
      C=0.0
      XMI=0.0
     HM=0.0
                                                             *A. 1
      Q=0.0
      0L=0.0
      FQ=0.0
      FA=0.0
      CS=0.0
      DI=n,n
      ₩0=0.0
      EN=0.0
      FS=0.0
      HY = 0.0
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(Table 4, continued)

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P

 $\mathbf{p}_{\mathbf{r}}$

p,

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```
ZMO=0.0
       AC=0.0
 C
       MOLECULAR PROPORTIONS CALCULATED
       SIO2=5102/60.09
       TIO2=1102/79.90
       AL203=AL203/101.96
       FE203=FE203/159.70
       FE0=FE0/71.85
       40.07\CMFX=OMMX
       XMG0=X-4GU/40.32
       CA0=CA0/56.08
       XNA20=XNA20/61.982
       XK20=XK20/94.20
       P205=P205/141.950
C
       PRINT75
    75 FORMAT(1H0,45%,21HMOLECULAR PROPORTIONS)
C
       PRINTED . ,5102.T102.AL203.FE203.FE0,XMN0,XMG0,CA0,XNA20,XK20,P20P
C
      15
   RA FORMAT (1H ,4X,11(F6.4,4X))
       FFO=FFO+X4NO
C
       PPOS TO APATITE
                                                                                P:
       APEP205
       CAU=CAU-3.3 #P205
                                                                                P,
C
       TIOP TO ILMENITE. SPHEME, RUTILE
                                                                                ٳ؞ۣڗ
       IF (FF0-1102)90
                           • H5
                                                                               Ωij
   PS XIL=TID?
                                                                               Pli
       FEU=FEU-110>
                                                                               \mathbf{p}_{d}
       60 TO 105
                                                                               Ρű
   90 XIL=FE0
                                                                               PI
       ۳
      FEO=0.6
                                                                               PF
       IF (CAO-T[02)100
                          • 95
                                  ,95
                                                                               çəç
   95 SP=1102
                                                                               P.
      CA0=CA0-T102
                                                                               Pf
      GO TO 105
                                                                               PL
  Inn SP=Can
                                                                               Ρį
       TIOS=LIOS-CVO
                                                                               P
      CAO=0.0
                                                                               Pl
      RU=T102
                                                                               اعآب
      KEO TO KALIOPHILITE AND POTASSIUM METASILICATE
                                                                               Pť
- 105 IF (AL203-KK20)115
                             · 1110
                                                                               ρŀ
  110 XKB=XK50
                                                                               Pŧ
      AL203=AL203-XK20
                                                                               ٦ĸ
      60 [0 120
                                                                               kQ.
  115 XKP=4L203
                                                                               Pi
      XK50=XK50-VF503
ដ
      AL203=0.0
                                                                               Ð.
      XKS=XK20
                                                                               Pt
C
      NAZO TO MEPHFLINE, : ACMITE, SODIUM METASILICATE
                                                                               P!
  120 [F(AL203-xNA20)130
                             •125 '
                                     ,125
                                                                               Pί
 125 XNE=XNA20
                                                                               Pŧ
      OSAMX-EOSTA-EOSTA
                                                                   7世紀2月
                                                                               Pª
      GO TO 145
                                                                               Pi
  130 KNE=AL203
                                                                               Pt
      KUSTV-OCVNX = USVNX
                                                                               PI
      AL203=0.0
                                                                               Pa
      IF (FF203-XNA20) 140
                             ,135
                                     ,135
                                                                               pi
  135 AC=XNA20
                                                                               P
      FE203=FE203-XMA20
                                                                               Pi
      GO TO 145
                                                                               ρį
  140 40=86503
                                                                               P:
      KHA20=XNA20+FE203
```

(Table 4, continued)

FF203=0.0

235 DI=XMO

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. OSAMS=20X
       AL203 TO ANORTHITE, AND CORUNDUM
  145 IF (CA-)-AL203) 155
                             155
                                                                                   ρ
  150 AN=AL203
                                                                                   P
       CA0=CA0-AL203
                                                                                   ρ
       60 TO 160
                                                                                   ρ
  155 AN=CAO
                                                                                   ρ
       AL203=AL203-CA0
       CAU=n.n
                                                                                   b.
       C=AL203
                                                                                   P
       FEROR TO MAGNETITE: HEMATITE
                                                                                   P
  169 IF (FE203-FE0) 165
                                                                                   P
                            ,165
  165 XMT=FE203
      FEO=FEO-FE203
                                                                                  þ
       GO TO 175
                                                                                   ټ.
  170 XMT≒FEO
                                                                                   P
      FE203=FE203+FE0
                                                                                   ρ
      FE0=0.0
                                                                                   O.
      HM=FF203
                                                                                   P.
      CAO, MGO, FEO TO OLIVINE, MONTICELLITE. CALCIUM ORTHOSILICATE
                                                                                   Pi
  175 XMGFF=XMGO+FFO
                                                                                   (A)
      RMGEF=XMGO/XMGEF
                                                                                   p;
      IF(YAGEE-CAD)180
                             .185
                                                                                  ρį
                                     ,185
  130 XMO=XHGFE
                                                                                   Pψ
      CAU=CAU-KMGFE
                                                                                   Οŀ
      CS=CAO
                                                                                  PI
      GO TO 190
                                                                                  PI
  195 XHO=CAD
                                                                                   \rho_i
      KAROFF = KAROFE = CQD
                                                                                  P
      OL=XMGFE
                                                                                   P_{i}
  190 SIO2=SIO2-SP-(2.0*XKP)-XKS-(2.0*XNE)-(4.0*AC)-XNS-(2.0*AN)-XMO-(CSPL
     3/2.0)-(02/2.0)
      IF (SIO2) 195
                      •270
                               ,205
                                                                                  PI
  195 CONTTIUE
                                                                                  Φ;
C 195 PRINT200
                   •ST02
: 200 FORMAT (1HD . 29X . 52HWOT ENDUNGH SIO2 TO FORM ALL UNDERSATURATED MINER
   = 1RALS \cdot 10X \cdot 7HSIOS = *F5.3
   CHECK PRINT CIAL. CHR.
                                                                                  P
      GO TO 375
                                                                                  P
5 SUR XXXKH=XKH#S.U
                                                                                  į,
      [F(S[02-XXXKP)210
                             ,210
                                                                                  Ρŧ
  210 (10=5102/2,1
                                                                                  ρ.
      メドレニスドレースドじ
                                                                                  ₽,
      GO TO 270
                                                                                  p_4
1 215 XLCHXKP
                                                               5, 6 2 2 4 4 7
                                                                                  Pi
      SIO2=SIO2-XXXKP
                                                               うずりょうじょ シャイス
                                                                                  Ρį
      XKP=0~0
                                                               SKP2 - Cy
                                                                                  Ρij
      CCSS=CS/2+0
                                                               10894 1 1/2 0 1
                                                                                  P
      IF (SI)2-CCSS)220
                                                                                  Pŧ
                            +220
                                     ,225
3.220 MO=2.0 45[02
                                                               11127 1 431 1
                                                                                  PĻ
      CS=CS-40
                                                                                  Pί
      60 TO 270
                                                                                  P
  225 40 mCS
                                                                                  Ρij
      $102=$102-CC$$
                                                                                  Pa
      CS=0.0
                                                                                  Pil
      IF(SIO2-XMO)230
                           ,230
                                   ,235
                                                                                  ٦į
  230 01=5102
                                                                                  Oil
      XM0=Y-10-ST02
                                                                                  p
      60 10 270
                                                                                  P
```

```
(Table 4, continued)
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```
XMO=0.0
       XXXEC=XEC#5.0
       IF (STOZ-XXXLC) 240
                             ,240
                                     ,245
  240 OR=ST02/2.0
       XLC=XLC=OR
       GO TO 270
  245 OR=XLC
       $102=$102-XXXEC
       XLC=0.0
       XXXNF=XNE#4.0
       IF (S[02-XXXNE) 250
                             ,250
                                     ,255
  250 AB=ST02/4.0
       ANE=XNE=AB
       GO TO 270
  255 AH=XNE
       SIDZ=SIDZ-XXXME +
       XME=0.9
       XXX01 = 0L/2.5
       IF (SIOZ-XXXOL) 260
                             +260
                                     ,265
  260 HY=SIO2#2.0
      OL=OL-HY
       GO TO 270
  265 HY=0L
       STO2=STO2-XXXOL
      OL#0.0
      N=SI02
C
      CONVERSION TO WEIGHT PERCENT:
  270 K=1.0 -RUGEE
      CS=CS+XMO
       XHODE # 436 3 601 ...
      FO=PMGFE*XMOOL
      FA=R#Y300L
      EN=HY#RMGFE
      FS=HY#3
      D1W0=D1*1.0
      DIEN=0[#RYGFE
      り[FS=D[#R
      AP=AP=328.88
      HU=RU#79.90
      C=C*101.96
      Q=0#60.09
      XKP=XKP#316.34
      XLC=XLC#436.52.
      UR#03#555.70
      CS#C5#86 • 125
      WO=WO#116.17
      XNE#XNE#284 . 1 22
      AB=A3#524.432
      FA=FA*101.895
      F0#F0#70+365
      EN#FN#100.41
Ŀ.,
      FS#FS#131.94
      HM#H4#159.79
      XMT=XMT#231.55
      AN=4/45/8*55
      XKS=XKS#154.29
      XN2=XN24155*01
۲.
      SP=SP#196.07
      XIL=YIL+151.75
      AC#AC#462+042
      D[00=0]V0*116.17
      DIEN=OIEN*100.41
```

```
(Table 4, continued)
        DIFS=DIFS*131.94
        UL≃FO+FA+CS
        DI=DIWO+DIEN+DIFS
        HY=EN+FS
        DIFINX=OR+AB+G+XNE+XKP+XLC
        COLINY=DI+HY+OL+XMI+XIL+AP
                                                                                  Ρ
        ASUM=(AP+XIL+SP+RU+XKP+XKS+XNE+AC+XNS+AN+C+XMT+HM+FA+CS+F0+XLC+WO+P
       1EN+OR+AB+FS+Q+DIND+DIEN+DIFS)
        PRINT275
                                                                                  P
   275 FORMAT(1H0,29X,32HC.I.P.W. NORM(IN WEIGHT PERCENT))
                                                                                  ρ,
   277 CONTINUE
 C 277 PRINT 280.
                      AP
                                * DIFINX
   280 FORMAT(IH , 34x, 7HAPATITE, 19x, F7.3, 20x, 21HDIFFERENTIATION INDEX, 10xP
       1 + F7 - 3)
 C.
        PRINT285
                    .XIL
                                 +COLINX
   295 FORMAT (1H +34x+8HILMENITE, 18X+F7.+3+20X+11HCOLOR INDEX+20X8F7.3)
                                                                                 ρ
        PRINTAGO
                    ·SP
                                                                                 ρ
                                                                                 ρ
   294 FORMAT(1H , 34X, 6HSPHENE, 24X, F7.3)
 C
                                                                                 p
       PRINT 295
                    • RU
   295 FORMAT(1H ,34X+6HRUTILE,20X,F7.3)
                                                                                  p.
 C
       OPETMISS
                    • XKS
                                                                                 Ρ
   300 FORMAT (1H.34X.14HK-METASILICATE.12X.F7.3)
                                                                                 P:
 C
       PRIMITION
                    * XKD
   305 FORMAT()H +344+13HKALIOPHILLITE+13X+F7.3)
                                                                                 ρ!
 C
       PRINTSLO
                    * XFC
                                                                                 \rho_{i}
   310 FORMAT (1H +34X+7HLEUCITE+19X+F7.3)
                                                                                 ρ
. C
                                                                                 ΟĮ
       PRIMITE 5
                    • ()P
   315 FORMAT(1H 34X, 10HORTHOCLASE, 16X, F7.3)
                                                                                 ΡĮ
 C
       PRIMISZU
                    *XIIS
                                                                                 Oį
   320 FURMAT(14 +34X+15MMA-METASILICATE+11X+F/+3):
                                                                                 131
 C
       PRINI325
                                                                                 [3]
                    , XNE
       PAHAN = 48/524.482 + AN/278.22
                                                                                 3
        IF (PABAN.GT.O.O)
                                                                                 P
      1PCNTAB = ((AB/524.482)/PABAN) * 100.
                                                                                 P
        IF (PABAN.G[.0.0)
                                                                                 1PCMIAH = ((AM/278.22)/PABAM) # 100.
                                                                                 P
       IF (PCNTAB.GE.90.0) ENCODE (20.490.NA:4E)
                                                                                 P
       IF (PCHTAB.LI.90.0) ENCODE (20.480.NAME)
                                                                                 Pi
       -JF(PCNYAB.LT.70.0)ENCODE(20,460,NAME)
                                                                                 P
      IF (PCHTA3.LT.50.0) ENCODE (20,440.NAME)
                                                                                 PI
      IF (PCMTAB*LT.30.0) ENCODE (20,420,NAME)
                                                                                 Ρį
       IF (PONTABALIATO, 0) ENCODE (20,410, NAME)
                                                                                 Αţ
       PEOFA = F0/70.345 + FA/101.895
                                                                                 Ρ.
       IF (PEDEA.GT.n.n)
                                                                                 Ρį
    3/1PCNTED = ((FO/70.365)/PFOFA) * 100.
                                                                                 P
       IF (PFOFA-GT-0-0)
                                                                                 Ρį
    記 MPCNTFA = ((FA/101.895)/PFOFA) * 100.0
                                                                                 Pi
    F. IF (PONTFO.GE.90.0) ENCODE 1(20,590, NAMEOL) .
                                                                                إدر ن
    FIGTE (PONTED-LT.90.0) ENCODE (20,580.NAMEOL)
                                                                                 Ρį
    * IF (PONTEO.LT.70.0) ENCODE (20,560, NAMEOL)
                                                                                 P)
    EXELEPTION LT. SQLQ), ENCODE ((20,540, NAMEOL)
                                                                             . . . . . . Pì
                                                       16 中。1777
、PP 生nCIF)E(PC27TFCP+LT+G3+H2D) ENCODE I(20"+520+NAMEOL)
     TIF (PONTFO-LT.10.0) ENCODE (20,510,NAMEUL)
                                                                                 \rho_{i}
   325 FORMAT(IH +34X+9HNEPHELINE,17X,F7.3)
                                                                                 Pá
       PRINT330
C
                    .AR
                                                                                 Ρģ
   330 FORMAT GLH ,34X,6HALBITE,20X,F7.3)
                                                                                 P
C
       PRINT335
                                                                                 Pi
                    14 A 🏚
   335 FORMAT () H . 34X, 9HANORTHITE, 17X, F7.3)
                                                                                 Pŝ
       PRINT340
                                                                                 P
                    • C
   340 FORMAT(1H ,34X +84C)RUNDUM,18X,F7.3)
                                                                                 P
C
       PRINISAS
                    TMX,
                                                                                 P
```

345 FORMAT(1H +34X+9HMAGNETITE+17X+F7+3)

```
(Table 4, continued)
· HM
• (2
```

```
C
       PRINT350.
  350 FORMAT(1H ,34X,8HHEMATITE,18X,F7.3)
C
       PRINT 155
  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 P
      1,/40x,10HF0RSTERITE,11x,F7.3/40x,8HFAYALITE,13x,F7.3/40x,16HCA-ORTP
      2HOSILICATE, 5X, F7.3)
C
       PRINTA65
                   .DI.DIWO.DIEN.DIFS.HY.EN.FS.WO.AC
  365 FORMAT(1H .34X,14HTOTAL DIOPSIDE,12X,F7.3,22H WITH THE COMPOSITIONP
      1,/40x,13HDIOPSIDE (w0),8x,F7,3/40x,13HDIOPSIDE (EN),8x,F7,3/40x,13P
      2HDIOPSIDE (FS),8x,F7.3/35x,17HTOTAL HYPERSTHENE, 9x,F7.3,20HWITH TP
      3HE COMPOSITION/40X.9HENSTATITE.12X.F7.3/40X.12HFERROSILLITE. 9X.F7P
      4.3/35X,12HwOLLASTONITE,14X,F7.3/35X,6HACMITE,20X,F7.3)
                   , ASUM
C
       PRINTATO
                                                                                  - ρ
  370 FORMAT(14 ,34x,3HSUM,23x,F7.3)
                                                                                  ρ
       PRINTES
C
                                                                                  þ
C
       IF (PASAN.GE.O.OO1).
                                                                                  P
Ç
      1PRINT 470, NAME, PONTAB, PONTAN
                                                                                  ρ
C
       IF (PFOFA.GE.0.001)
                                                                                  p-
      IPRINT 570. NAMEOL. PCNTFO, PCNTFA
                                                                                  P
  375 CONTINUE
                                                                                  تا
       IF (LE 10NF.GE.2) GO TO 610
                                                                                 ďρ.
       LEMONF = LEMONE + 1
                                                                                  \rho_{i}
       UTEP=100.0/0/ASUM
                                                                                  O;
       PRIMI 26.K.A.B.
                                                                                  \rho_{i}
C
       PRINT 17, ARRAY
C
                                                                                  (7);
   24 FORMAT (1H1,6(/),49X,7HSAMPLE,13,2A1,8H + FUDGE
                                                                                  Ρij
       SIO2=SIO2A*UTEP
                                                                                  P
       $37U*\:\C\]\T_\\\\\
                                                                                  Ϋ́
       AL203=AL203A*UTEP
                                                                                  Ρil
       FE203#FE203A#UTEP
                                                                                  12
       FEO=FEOA*UTEP
                                                                                  Pil
       XMNO#XMNOA#UTFP
                                                                                  P
       XMG()=XMG()A#UTFP
                                                                                  Pľ
       CAO=CAOA*UTEP
                                                                                  Pil
       XMA20=XMA20A#UTEP
                                                                                  \rho_{i}
       XK20=XK20A*UTEP
                                                                                  Pii
       P205=P205A*UTEP
                                                                                  P
      OTHER=0.0
                                                                                  Pķ
       IF (SID2) 30,30,40
                                                                                  PI:
      FORMAT (SOH ANORTHITE
                                                                                  PI
4110
                                                                                  Ol
      FORMAT (204 BYTO WHITE
420
      FORMAT (20H LABRADORITE
440
                                                                                 \mathbf{p}:
      FORMAT (20H ANDESINE
460
      FORMAT (50x, 20HPLAGTOCLASE FELDSPAR/50X, 5A4/50X, 4H(
470
     1F7.3.2H ) )
                                                                       3
                                                                                  μ;
      FORMAT (20H OLIGOCLASE
                                                                                 \mathcal{R}^{i}
480:
490
      FURMAT (20H ALBITE
                                                                                  \rho_{i}
  510 FORMAT (2)H FAYALITE : "
                                                                                 Ό,
HI SOULEDRMAT (20H FERROHORTONOLITE
                                                                           FFR KINDPA
                                                          Sec. 16 1.
                                                                   1 1
                                                          到49年 FOR"AT
P. SIGNOF EORMAT . (20)H HORTONOLITE : 1 1 1
                                                                           F.U.S.L.9.3-15
                                            )
  560 FORMAT (20H HYALOSIDERITE
  570 FORMAT (50%, 7HOLIVINE/50%,5A4/50%,4H( FO,F/.3,3H FA,F7.3,2H ) )
                                                                                  P1
  580 FORMAT (20H CHRYSOLITE
                                                                                  Pί
                                            ١
  590 FORMAT (20 H FORSTERITE
                                                                                  \rho_{1}
  610 CONTINUE
                                                                                  Pi
       IF (LEMONE.GE.3) GO TO 620
                                                                                  P1
      LEMONE=LEMONE + 1
                                                                                : P1
       VAP=AP/3.139
                                                                                  PŁ
      VRU=RU/4。250
                                                                                  PL
       VC=C/3±988
```

```
VO=0/2.648
 VXKP=XKP/2.610
 VXLC=XLC/2.480
 VOP=09/2.551
 VCS=CS/2.938
 AMU=40/5.800
 VXNE=XNE/2.623
 VAB=43/2.617
 VFA=FA/4.393
 VF0=F0/3.214
 VEH=EN/3.198
 VFS=FS/3.5
 VHM=HM/5.274
 VXMT=XMT/5.200
 VAU=A41/2.762
 VXKS=XKS/2.500
 VX\\S=X\\S/2.400
 VSP=SP/3.250
 VXIL=XIL/4.786
 VAC=AC/3.500
 406.270#IC=CPIUA
 ADIEN=DIEN/3.188
 VDTFS=DIFS/3.500
 VHY=VF-1+VFS
 VDI=VDIAO+VDIEN+VDIES
 VOL=VFA+VFO+VCS
 ACOFTHX=AU1+AHX+AUF+AXM1+AXIF+AVB
 VASU 4= (VAP+VXIL+VSP+VEU+VXKP+VXKS+VXNE+VAC+VXNS+VAN+VC+VXMT+VHM+VFP
14:705
          */C5/150+7/LC+v...J. VE... + vo... + vas + +/5 + va+ vo.1+3+ vo.1 En+ vo.1 FS)
 ADAMS=100.0/VASU4
 VDIFSA=VDIFS*ADAMS
 VAPB=VAP*ADAMS
 VDIENH=VDIENMADAMS
 VDIFSA=VDIFS#ADAMS
 VRUBEVRUFADAMS
 VCH=VC*ADAMS
 VOR=VORADAMS
 VXKPR=VXKP*ADAMS
 VXLC3=VXLC*ADAMS
 SMAGA#RGV=890V
· VCSB=VCS#ADA49
 VWOB=VWOMADAMS
. VXNEG=VXNE#ADAMS
 VARB=VAB*ADAMS
.VFAB=VFA#ADAMS
 VFO8=VFO#ADAMS
· VENR=VEN*ADAMS
 VFSB=VFS*ADAMS
 VHMB=VHM*ADAMS
I-VXMTB=VXHT#ADAMS
                                                   1 42 1 . . / X . . F () .
I VANB=VAN#ADAMS
~VXKS3=VXKS≉ADAMS
 VXMSP=VXNS*ADAHS
 VSPB=VSP#ADAMS
 VXILH#VX[L#ADAMS
 VACB=VAC*ADAMS
~ VD[woH=VD]#0#ADAMS
 VHYB=VHY#ADAMS
VDIB=VDI#ADAMS
VOLB=VOL*ADAMS
VDIFINXH=VDIFINXWADAHS
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(Table 4, continued)
      VCOLINXB=VCOLINX*ADAMS
      VASUMR=VASUM#ADAMS
  611 CONTINUE
C
      PRINT 27,K,A,R
   27 FORMAT (1H1,6(/),49X,6HSAMPLE,14,2A1,/,49X,34HCALCULATED C.I.P.W.
     IVOLUME PERCENT)
C
      PRINT 17, ARRAY
       AP=VAPB
      DIEN=ADIENS
      DIFS=VDIFSB
      RU=VRUB
      C=vC4
      Q=VQ3
      XKP=VXKP3
      XLC=VXLCS
      ひお=2023
      CS=vCSA
      80=V403
      XNE=/XNE8
       AB=VABB
      FA=VFAB
      FQ=VFOR
      ENEVENR
      FS=VFS3
      HM=VH14
       XMT=VXMTB
       AN=VAMB
       XKS=VXKS9
       XMS=VXMSB
       5H=13H3
       XIL=VXILB
       4C=v4C3
      BONIOv=OWIO
       HY=VHYH
       DI=VOI3
       OL=VOL3
       ASUM=VASUMB
       GO To 277
  SZO CONTINUE
       SI02=51024*UTEP
       IF (LEMONE.GE.4)622.623
  622 WRITF (49) COLINX . DIFINX . SIO2
       WRITE (10) ABDAY
       NPTS=HPTS+1
       GO TO 10
  623 LEMONE=LEMONE+1
       はい=vの3
1.
       KF=VOR8
       PLAG=VABB+VANR
      FOIDS=VXNEB+VXLCB+VXKPB
     I TOTQUAR=QU+KF+PLAG+FOIDS | I' |
                                                            101 7 3 12 5
中部 AXI QUIDAN VEARABLE A MYCB A MXXBBI HANXRSB + ADIB 计: MHXB1 421 ANDBEARDB
       TOTOLV=VOLB
       TOTORE=VXMTB + VXILB + VHMR + VRUB
       TOTAIJX=VCB + VAPB
       TOTLEC=TOFQUAR + TOTAUX
       TOTMAR=101PYAM + TUTOLV + TOTORE
       TOIMFL=TOIMAF
                                                            11
       IF (PLAG.GT.0.0)
      1PCNIVAB=VABB/PLAG * 100.
```

IF (TOTMAF.GT.O.O)

IPCNTORE=TOTORE/IDIMAF * 100.

```
(Table 4, continued)
970 IF (TOTLEC.LT. 5.0) GO TO 930
    IF (TOTLEC.LI.50.0) 60 TO 920
    IF(TOTLEC.LT.95.0) 60 TO 910
960 1F(TOTLEC.GE.95.0) GO TO 900
    IF (PCMTVAB.LT.10.0) ENCODE
    GO TO 975
```

```
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)
                                           (20.904.CONAME)
        910 IF (PCNTVAB.GE.90.0) ENCODE
                                            (20,911,CONAME)
              IF (PCMTVA9.LT.90.0) ENCODE
                                            (20,912,CONAME)
              IF (PCMTVAH.LT.50.0) ENCODE
                                           (20,913,CONAME)
              IF (PCNTVAB.LT.10.0) ENCODE (20,914, CONAME)
              GO TO 975
        ~ 920 IF (PCMIVAB.GE.90.0) ENCODE
                                           (20,921,CONAME)
              IF (PCNTYAR.LI.90:0) ENCODE
                                           (20,922,CUNAME)
            CIFTPORTVABILIASOLDI ENCODE (20,923,CONAME)
                                                                  " 15" (PODT)
          * "IF-(PCHTVAB-LT:10.0) ENCODE (20,924,CONAME)
              60 To 975
         980 IFTPORTURE: GE: 90.8) ENCODE (20, 931, CONAME)
              IF (PCNTORF.LT.90.0) ENCODE (20,932,CONAME)
          IFTPCMTORE.LT.50.0) ENCODE (20.933.CONAME)
         SECULER PROSTORE . LT. 10:0) ENCODE: (20,934, CONAME)
         POIL FORMAT (20H
                            CLASS 1
                                      ORDER 1
                                                )
        " 902" FORMAT (20H
                            CLASS 1
                                      ORDER 2
       " 9030 FORMAT (2) H
                            CLASS 1
                                      ORDER 3
         904 FORMAT
                     (2)4
                            CLASS 1
                                      ORDER 4
        2911 FORMAT
                     (294
                            CLASS 2
                                      ORDER 1
         912 FORMAT (21H
                            CLASS 2
                                      ORDER 2
         DIS EUROVI (SOH
                            CLASS 2
                                      0.302.0 3
         914. FORMAT (28H
                            CLASS ?
                                      ORDER 4
         921 FORMAT (20H
                            CLASS 3
                                      080ER 1
         922 FORMAT (20H
                            CLASS
                                  3
                                      ORDER 2
                                                )
         923 FORMAT (20H
                            CLASS 3
                                      OHDER 3
         924 FORMAT (20H
                            CLASS 3
                                      ORDER 4
                                                )
         931 FORMAT (20H
                            CLASS 4
                                      ORDER 1
                                                )
                                                                                      P
         932 FORMAT (26H
                            CLASS 4
                                      ORDER 2
                                                )
         933' FORMAT (20H
                            CLASS 4
                                      ORDER 3
                                                )
         934 FORMAT (20H: CLASS 4
                                      ORDER 4
                                                                                     - PI
                                                ")
              IF (TOTMAF . GT . n . n)
            APCMTOLV=TOTOLV/TOTMAF * 100. 10
            - IF (&CNFOLV.GE.95.0)
                                      ENCODE (28 ,971,7NAME)
            ( )Fr (PCNTOLV.ET.95:0)
                                                                                    i z Pļ
                                      ENCODE
                                             (28 ,972,ZNAME)
            SIFT (PONTOLY.LI.50:0)
                                      ENCODE
                                             (24 ,973, ZNAME)
                                                                                      ,P
            SIF (PONTOLVALTA 540)
                                      ENCODE
                                             (28 ,974,ZNAME)
              GO TO 621
       P. 971 FORMAT (28H FAMILY) 0
                                                                   E0004 11550
                                                                               F ( 'II ) )P)
       1 972, FORMAT (28H FAMILIES ),2,3,4
                                                           )
         973 FORMAT (28H FAMILIES 5,6,7,8
                                                                       .s r
                                                                          - (ግ፡፣ 1 E A 15
                                                                                      ٦Þ٢
                                                                   ENDONALL AND TO TELL ATT
       ~ 974 FORMAT: 128H FAMILIES 9,10,11,12
                                                          .)
       ≠ 975 QUEOTOS=QU+FOIDS
                                                                   いき ローバー ルイルフラブル
₹2-00 7 PN 1E) > ENCQQB+ (28,2000∓ZNAME) +
                                                             P (C) > EUCOOR (25,2000,7 P)
       .2000 FORMAT (29X)
             KEPLAG= KE+PLAG
              IF(KEPLAG.GT.a.a)
           . 1PCNTKF= KF/KFPLAG*100.
                                                                                     O)
                (QU.EQ.0.0) GO TO 977
             ΙF
                                                                   1 5
              IF ([OTQUAR.GT.O.O)
         T. 1PCMTOU=QU/TOTGUAR#100.
                                                                                    ğα..
                (PCMIDU.LI. 5.0) GO TO 830
              IF (PCMTAU.LT.50.0) GO TO 820
              IF (PCNTQU.LT.95.0) CO TO 810
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(Table 4, continued)
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(PCNTQU.GE.95.0) ENCODE (20.800.MNAME)
      977 IF (FOIDS.EQ.0.0) GO TO 621
          IF (INTQUAR.GT.O.0)
         1PCMTFD=FUIDS/TUTQUAR*100.
          IF (PCNTFD.Lf. 5.0) GO TO 840
          IF(PCN[FD.LT.50.0) GO TO 850
          IF (PONTED.LI.95.0) GO TO 860
          IF (PCNTFD.GE.95.0) ENCODE (20,870, MNAME)
      810 IF (PCNTKF.GE.95.0) ENCODE (20,816, MNAME)
              (PCNTKF.LT.95.0) ENCODE (20,817, MNAME)
             (PCNTKF.LT.50.0) ENCODE (20.818, MNAME)
          IF
             (PCNTKF.LT. 5.0) ENCODE (20,819, MNAME)
          GO TO 621
      820 IF
             (PCN (KF + GE + 95 + 0) ENCODE (20 + 824 + MNAME)
          1F
             (PCNTKF.LT.95.0) ENCODE (20,827, MNAME)
             (PCNTKF.LT.50.0) ENCODE (20,828.MNAME)
         . IF
             (PCYTKF.LT. 5.0) ENCODE (20,829, MNAME)
                                                                                 , P.
          GO.
             TO 521
             (PCNTKF.GE.95.0) ENCODE. (20,836,MNAME)
    - 830 IE
          ΙF
             (PCNTKF.LT.95.0) ENCODE (20.837, MNAME)
             (PCNTKF.LT.50.0) ENCODE (20,838,MNAME)
          IF
             (PCMTKF.LT. 5.1) ENCODE (20,839, MNAME)
          GO TO 621
                                      30 1
    4 840 IF
             (PCMTKF.GE.95.0) ENCODE. (20,846, MNAME)
          IF (PONTKE, LT. 95, 0) ENCODE (20,847, MNAME)
          IF
             (PONTKE .LT.50.0) ENCODE (20.848.4NAME)
          IF
             (PCNTKF.LT. 5.0) ENCODE (20,849,4NAME)
          60 TO 621
     8°0 IF
             (PCMTKF.GE.95.0) ENCODE (20,856,MNAME)
             (GC) (AC (LT. Faca)) Encord
                                       べとりょひひきょ かれかのにき
          IF
             (PCHTKE.LI.50.0) ENCODE (20,858, MNAME)
          IF
             (PONTKE-LT. 5.0) ENCODE (20,859,MNAME)
          90 TO 521
    7 884 IF
             (PCNTKF.GE.95.0) ENCODE (20,866,MNAME)
             (PCMIKE.LT.95.0) ENCODE
                                       (20,867,MNAME)
             (PCMTKF.LT.50.0) ENCODE (20,868, MNAME)
          IF (PONTKE .LT. 5.7) ENCODE
                                       (20,869,MN4ME)
    F BOO FORMAT (ZOHFAMILY O
    - 816 FORMAT (20HEAMILY
     317 FORMAT (20HFAMILY
    FORMAT
                 (S)HFAMILY
                              3
                                                                                ; P
    - 819 FORMAT (20HFAMILY
     825 FORMAT (20HFAMILY
   7 B27 FORMAT
                 (20HFAMILY
                                                                       1.7
                              6
     328 FORMAT (2) HEAMILY
                              7
    1.829 FORMAT (20HEAMILY
                                                                      1 4
                                                                                (C)
    P. 836 FORMAT (20HEAMILY
                                                                  PAT
                                                                      1,2
                                                                          四个在7111字中
   F1837 FORMAT (20HFAMILY 10
                                                                      1.
                                                                          iii - Li i Pl
    1838 FORMAT (ZOHFAMILY 11
                                                                      17
    1839 FORMAT (20HFAMILY
                                                                                 . [2]
10 MB46 FORMAT (2) HEAMILY 13
                                                               7 76 16
                                                                      ( 2
                                                                          FA-TE PA
"IL - PRESABLE ORMAT (20HEAMILY 14
                                       10%
                                                               FOH! AT
                                                                          ·FAPILIPI
                                                                      ( )
    "BAS FORMAT (ZOHFAMILY 15
     849 FORMAT (2)HEAMILY 16
     854 FORMAT (20HFAMILY 17
     857 FORMAT (20HFAMILY 18
     853 FORMAT
                 (SUHEAMILY 19
     859 FURMAT (2) HEAMILY 20
     866 FORMAT (20HFAMILY 21
     847 FORMAT (2) HEAMILY 22
     BER FORMAT (20HFAMILY 23
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369 FORMAT (20HEAMILY 24

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870 FORMAT (20HFAMILY 25
   621 CONTINUE
       PRINT 37,K,A,R
    37 FORMAT(1H1,49X+6HSAMPLE,14,2A1,/,49X,25HJOHANNSEN CLASSIFICATION
C
       PRINT 17, ARRAY
C
       PRINT
             1010
 1010 FORMAT (30X, 14H). QUARFELOIDS)
       PRINT 1020. . VOB
  1020 FORMAT (34X, 14HA. (QU) QUARTZ, 18X, F7.3)
       PRINT 1030, VORS
 1030 FORMAT (34X, 18HS. (KF) ORTHOCLASE, 14X, F7.3)
       PRINT 1040 .
                    VARR
 1040 FORMAT (34X,17HC. (VABB) ALBITE,15X,F7.3)
       PRINT 1050.
                   VANH
 1050 FORMAT (42X; 11H+ ANORTHITE, 13X, F7.3)
       PRINT 1050. PLAS
 1060 FORMATI (37X+17HTOTAL PLAGIOCLASE+12X+F7+3)
      PRINT 1070, VXNEB
 1070 FORMAT (34X+20HD. (VXNEB) NEPHELINE+12X+F7+3)
       PRINT 1080, VXLCB
 1080 FORMAT (45X,98+ LEUCITE,12X,F7.3)
       PRIME 1090.
                   VXKDB
 1000 FORMAT (45%.15H+ KALIOPHYLLITE.6X.F7.3)
      PRINT 1100, FOIDS
 1100 FORMAT (37X+18HTOTAL FELSPATHOIDS+11X+F7+3)
      PRIRE 1110. TOTOUAR
 1110 FORMAT(33%,27HTOTAL QUARFELOIDS (TOTQUAR),6X,F7.3)
      PRINT 1120
 1120 Furthal (3) Kylunz. MARITES)
      PRINT 1130
 1130 FORMAT (34X,1)HA.PYRIBOLES)
      PRINT 1144 VSPB
 1140 FORMAT (39X+6HSPHENE+21X+F7+3)
      PRINT 1150.
                    VACR
 1150 FORMAT (37X,8H+ ACMITE,21X,F7.3)
      PRINT 1150. VXNS9
 1150 FORMAT (37X,22H+ SODIUM METASTLICATES,7X,F7.3)
      PRINT 11/0. VXKSB
 1170 FORMAR (37X,22H+ POTASH METASILICATES,7X,F7.3)
      PRINT 1180. VUIR (
- 11HO FORMAT (37X, 10H+ DIOPSIDE, 19XF7.3)
      PRINT 1190, VHYR
11190 FORMAT (37X, 13H+ HYPERSTHENE, 16X, F7.3)
      PRINT 1200. V008
TIZNO FORMAT (37X FIAH+ WOLLASTONITE + 15X + F7 . 3)
iC .
      PRINT 1210.
                   MAYSTOT
PIZIO FORMAT (36X, 16HTOTAL (TOTPYAM), 14X, F7.3)
      PRINT 1220
Place FORMAT (34X,10HB. OLIVINE)
C , ; PRINT 1221,
                   VEOB
PINZACIFORMATO (39%, InHFORSTERITE $17%, F7.3)
      PRINT 1222,
                   VFAH
 1222 FORMAT (39X, 8HFAYALITE, 19X, F7.3)
      PRIMIT 1223, VCSA
 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)

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(Table 4, continued)
      PRINT 1260, VXILB
 1260 FORMAT (39x. SHILMENITE, 19x, F7.3)
      PRINT 1270, VHM3
 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, VCH
 1310 FORMAT (39X,8HCORUNDUM,19X,F7,3)
      PRINT 132n, VAPB
 1320 FORMAT (39X.7HAPATITE, 20X, F7.3)
      PRINT 1330, TOTAUX
"133" FORMAT (37X, 24HTOTAL 'AUXILIARY (TOTAUX), 5x, F7, 3, //) "
      PRINT 1340 TOTLEC
11340 FORMAT (50X, 11HLEUCOCRATES, 18X, F7.3)
      PRINT 1350, TOTMEL
1350 FORMAT (50X, 10HMELUCRATES, 19X, F7.3.///)
      PRINT 1360. CONAME
-1360 FORMAT (40 X + 6HCONAME + 14 X + 5A4)
      PRINT 1370. MNAME
1370 FORMAT (40X+5-DINAME+15X+544)
      PRINT 1380, ZNAME
 1380 FORMAT (40X, 5HZNAME, 15X, 7A4)
      GO TO 620
  384 ENDFILE 49
      HEWIND 49
```

FORTRAM DIAGNOSTIC RESULTS FOR ROCKPLOT

NULL STATEMENT	NUMBERS -	. 1		Cal	·
1380	1370	1360	1350	1340	1330
1290	1.58.0	1270	1:260	1250	1240
TS5.1	1.55.0	1210	1:2:00	1190	1180
1140	1139	1120	1:F10	1100	1090
1.020.	1040	1030	1020	1010	37 ′
611	570	470	5.6.	370	3'65'
345	340	335 .	33.0	3257	320°
300	295	290	285	2807	275
70	. 65	55	50	45	35

REaligh 10

END

CALL SUBPLOT

```
SUBPOUTINE SUBPLOT
     COMMON DIFINX (1000) .SIO2(1000) .NPTS
     DIMENSION ARPAY (10)
     DIMENSION NP (50)
     REWIND 49
     PRINT 1000
1000 FORMAT (1H1)
     READ 1500, N, (NP(I), I=1,N)
1500 FORMAT (12/(2613))
     I = 1
     D0 1 K = 1.N
     NMAX = NP(K)
     XAMMeT = U S OG
     RFAD (49) COLINY, DIFINX(I), SIO2(I)
     READ (10) ARRAY
     PRINT. 1400; COLINX:DIFINX(1):SIO2(1):ARRAY
   2I = I + I
   1 PRINT 1000
     READ 1400. SMIN. SMAX
     READ 1400. XLEN.YLEN
     READ 1400 + OMIN + DMAX
1400 FORMAT (3F10.5,5X,10A8)
     K = 1
     DO 10 I = 1.4
     NPTS = NP(T)
     CALLPLOTTER (SIO2(K) , DIFINX(K) , SMIN , SMAX , DMIN , DMAX , XLEN , YLEN , NPTS , 3P
    1,-1,0,1,-1)
  13 K = K > MP(I)
     RETURN
     END
```

FORTRAN DIAGNOSTIC RESULTS FOR SUBPLOT

NO ERRORS LOAD,56 RUN,5