DEPARTMENT OF THE INTERIOR

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User's Manual for REFORM: A Rock-Sample Database Program in FORTRAN-77

by

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DISCLAIMER

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INTRODUCTION

GENERAL DESCRIPTION

REFORM is a program that allows you to create and use a database of rock sample data. It has sections for information on sample location, formation, rock type, characteristics (e.g., modes), major and trace element chemistry, and isotopes. It is especially suited to igneous rocks.

REFORM generates printouts of sample data, reformats chemical data for GNAP and TOMGNAP (normative calculation programs), and generates tables of selected data fields. These tables are among the most useful products of the system because they can be used by many other programs, such as graphics and statistical packages, on both large computers and PC's.

For portability of the database , data is stored in ASCII text files. For portability of the REFORM system, the software is written in FORTRAN-77. REFORM is currently installed on the U.S. Geological Survey Information Systems Division VAX/VMS in Menlo Park. REFORM's hierarchical structure and input and output routines can be modified with relatively simple programming.

REFORM provides no query language for the direct selection of data from the database according to selection criteria, but data can be selected by a combination of sorting and editing. Alternatively, a table of data can be transfered to a microcomputer database program, such as Lotus Symphony, whose query language can be used.

Data is stored in one or more text files. New data can be added with REFORM's interactive data entry routine, or via an editor or punched cards. Sorting of database sample entries is done with one of REFORM's routines and/or with a text editor . Corrections to data are made with a text editor.

An initial version of REFORM was written in PL1 by Ming Ko using MRDS on a Honeywell Multics computer. Charlotte Allen assisted with program testing. The FORTRAN version described here is a new stand-alone revision with substantial extensions. It was developed in conjunction with the Pacific-to-Arizona-Crustal-Experiment (PACE) by Bob Simpson and Todd Fitzgibbon.

GETTING STARTED

This manual describes how to use REFORM version 2.1. It uses examples generated on a VAX/VMS computer using a database of samples from Keith Howard's Needles 1 by 2 Degree Quadrangle project at the USGS Western Regional Geology branch at Menlo Park. This database is called Mojaverox.

This manual assumes you know how to perform basic tasks on a VAX/VMS computer, including using the VAX/VMS editor EDIT/EDT in both screen and line modes.

Examples will be actual copies of output or terminal sessions, where possible, to reduce errors. Input to be typed by you will be underlined. A carriage return should be typed after each command line; however, carriage returns are not shown on printouts.

Begin by reading the rest of this introduction. Then try creating a small database with REFORM's interactive data entry routine, option A, described on page 32. From there try producing a printout with option B, and a table with option C. This should give you a good feel for the database format and REFORM's capabilities.

DATABASE FORMAT

Data is stored in one or more text files, referred to as card files. Each sample is stored as a set of records (cards) which are subdivided into one or more data blocks (e.g., LOCATION) containing information of a particular type. Not all kinds of data blocks need be present for any one sample. See page 4 for a printout of the database format, with underlines showing field sizes, and page 6 for a glossary of database terms. Only those fields for which information is available need be entered. Block names (e.g., LOCATION) and field names must be spelled exactly as shown and be positioned in the exact column shown. To make this easy, REFORM has a data entry routine (see below).

Note that this database has a strict column-oriented format, a characteristic inherited from the original Multics program in which input was in the form of punched cards (and thus the term "card files"). The data entry routine allows you to completely ignore columns and lines, thankfully, except when making minor corrections and additions. This is explained in the sections on Error Handling, and Modifying and Deleting Data.

For a given sample entry, at most one copy of each block may be present. That is , only one CHARACTERISTICS block (therefore only one mode per sample), only one CHEMISTRY block (therefore only one of each of the three types of analyses provided for), etc. Additional data can be handled either by averaging or having multiple entries into the database with slightly modified sample names (e.g., H8OMH-11', H8OMH-11'', etc.)

Each field, with the exception of the comment and source fields, has an alphanumeric key that is used to specify output items in REFORM's table routine. In general, numeric data has numeric keys and character data has alphabetic keys. Some numeric fields, such as CPS, that have variable formats or multiple entries, have alphabetic keys. See page 8 for a list of these keys.

Numeric fields may contain the less-than sign (<). It will appear on printouts (option B) of the data, but when the data is output for tables (option C) or for TOMGNAP files (option E) the number without the less-than sign will be used.

See page 10 for a list of field name abbreviations.

Page 11 shows a partial printout of a cardfile. Note that these sample entries have no CHEMISTRY or ISOTOPE blocks, and only a few comment fields.

FORMAT FOR A SAMPLE ENTRY SHOWING DATA BLOCKS AND FIELD SIZES

```
SAMPLE NO=________________
 LOCATION:
         MOUNTAIN RANGE=________________
         LATITUDE=_____    LONGITUDE=______
         QUADRANGLE=____________________________
         TRS=________
         SOURCE=_____________________________________________
         SOURCE=_____________________________________________
         SOURCE=_____________________________________________
         SOURCE=_____________________________________________
         SOURCE=_____________________________________________
         SOURCE=_____________________________________________
         SOURCE=_____________________________________________
         SOURCE=_____________________________________________
         SOURCE=_____________________________________________
         SOURCE=_____________________________________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
         COMMENT=$$$
 FORMATION:
         FORMATION SYMBOL=________________
         FORMATION NAME=_____________________________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
         COMMENT=$$$
 ROCK TYPE:
         ROCK TYPE=__________________________________
         GRAIN SIZE=_________________________________
         TEXTURE=____________________________________________
         TEXTURE=____________________________________________
         TEXTURE=____________________________________________
         TEXTURE=____________________________________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
         COMMENT=$$$
 CHARACTERISTICS:
         CPS=__________ SG=____ CI=____ MAG=______
         SN=____ SQ=____ SP=____ SA=____ SM=____
         TN=____ TQPA=____ TB=____ TH=____ TM=____ TSP=____ TMG=____
         %Q1=____ %P1=____ %A1=____ %Q2=____ %P2=____ %A2=____ %M2=____
         OTHER MINERALS=_____________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
         COMMENT=____________________________________________
```

COMMENT=_____
COMMENT=_____
COMMENT=$$$

CHEMISTRY:

ANALYSIS 1 BY: _____

SIO2=_____	TIO2=_____	AL203=_____	FE203=_____	FEO=_____
MNO=_____	MGO=_____	CAO=_____	NA2O=_____	K2O=_____
P2O5=_____	H2O+=_____	H2O-=_____	CO2=_____	TOTAL=_____
Y=_____	SR=_____	ZR=_____	U=_____	RB=_____
TH=_____	PB=_____	GA=_____	ZN=_____	CU=_____
NI=_____	CR=_____	V=_____	BA=_____	NB=_____

$$$

ANALYSIS 2 BY: _____

SIO2=_____	TIO2=_____	AL203=_____	FE203=_____	MNO=_____
MGO=_____	CAO=_____	NA2O=_____	K2O=_____	P2O5=_____
Y=_____	SR=_____	ZR=_____	RB=_____	BA=_____
NB=_____	FEO=_____			

$$$

ANALYSIS 3 BY: _____

FE=_____	K=_____	NA=_____	BA=_____
CO=_____	CR=_____	CS=_____	HF=_____
MN=_____	RB=_____	SB=_____	SR=_____
TA=_____	TH=_____	U=_____	ZR=_____
SC=_____	LA=_____	CE=_____	ND=_____
SM=_____	EU=_____	GD=_____	TB=_____
DY=_____	TM=_____	YB=_____	LU=_____
HO=_____			

$$$

RATIOS: BA/RB=_____ BA/SR=_____ RB/SR=_____
RATIOS: U/TH=_____ K/RB=_____ K/BA=_____
COMMENT=_____
COMMENT=_____
COMMENT=_____
COMMENT=_____
COMMENT=_____
COMMENT=$$$

ISOTOPES:

ANALYSIS=____ ANALYST=_____ MINERAL=____
AGE=_____ RATIO=_____
ANALYSIS=____ ANALYST=_____ MINERAL=____
AGE=_____ RATIO=_____
ANALYSIS=____ ANALYST=_____ MINERAL=____
AGE=_____ RATIO=_____
ANALYSIS=____ ANALYST=_____ MINERAL=____
AGE=_____ RATIO=_____
ANALYSIS=____ ANALYST=_____ MINERAL=____
AGE=_____ RATIO=_____
ANALYSIS=____ ANALYST=_____ MINERAL=____
AGE=_____ RATIO=_____
COMMENT=_____
COMMENT=_____
COMMENT=_____
COMMENT=_____
COMMENT=_____
COMMENT=$$$

GLOSSARY OF REFORM DATABASE TERMINOLOGY

database (e.g.,MOJAVEROX)

This is one or more text files (card files) containing the sample entries in REFORM format.

card file (e.g., CARD80.FIL)

This is a single text file usually containing entries for many samples in REFORM format. For convenience, large databases may be divided into more than one card file. For example, we have found it useful to divide the database into separate files for each field season. These may then be concatenated if desired for processing by one of the REFORM menu options.

sample entry (e.g.,H79TM-92)

This is the set of cards that contains the information about a single sample location. The first card starts with "SAMPLE NO=". One or more data blocks follow this first card.

data block or block (e.g., LOCATION)

This is a group of records or cards that contain information for related fields. Each data block begins with a card that ends in a colon, like "LOCATION:", and is terminated by a line with COMMENT=$$$ beginning in column 11.

fieldname (e.g., LATITUDE)

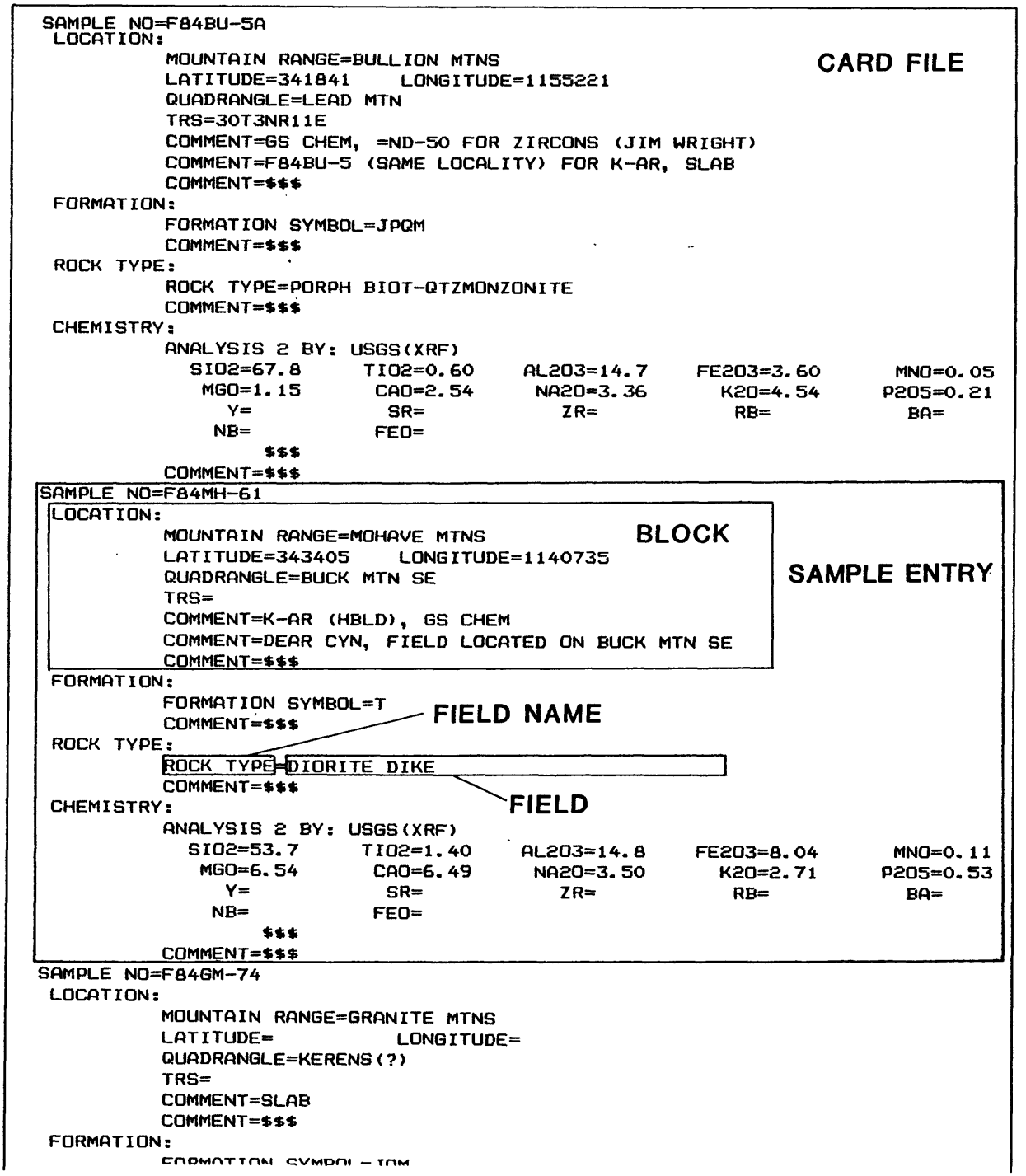
The fieldname is the label for a particular item of data for the sample.

field (e.g., 345102)

This is the data element itself. For example, the LATITUDE field contains numbers, not letters, and is six characters long. In the example, the field contains the latitude 34d51m02s.

On the next page is a diagram showing the above relationships.

DIAGRAM OF REFORM DATABASE TERMINOLOGY



FORMAT SHOWING FIELD KEYS

```
SAMPLE NO=A
 LOCATION:
         MOUNTAIN RANGE=B
         LATITUDE=1          LONGITUDE=2
         QUADRANGLE=C
         TRS=D
         SOURCE=
         SOURCE=
         SOURCE=
         SOURCE=
         SOURCE=
         SOURCE=
         SOURCE=
         SOURCE=
         SOURCE=
         SOURCE=
         COMMENT=SHAWNO=XXX S    (KEY T)
         COMMENT=
         COMMENT=
         COMMENT=
         COMMENT=
         COMMENT=$$$
 FORMATION:
         FORMATION SYMBOL=E
         FORMATION NAME=F
         COMMENT=
         COMMENT=
         COMMENT=
         COMMENT=
         COMMENT=
         COMMENT=$$$
 ROCK TYPE:
         ROCK TYPE=G
         GRAIN SIZE=H
         TEXTURE=
         TEXTURE=
         TEXTURE=
         TEXTURE=
         COMMENT=
         COMMENT=
         COMMENT=
         COMMENT=
         COMMENT=
         COMMENT=$$$
 CHARACTERISTICS:
         CPS=I            SG=3     CI=4     MAG=5
         SN=6     SQ=7     SP=8     SA=9     SM=10
         TN=11    TQPA=12    TB=13    TH=14    TM=15    TSP=16    TMG=17
         %Q1=18    %P1=19    %A1=20    %Q2=21    %P2=22    %A2=23    %M2=24
         OTHER MINERALS=J
         COMMENT=
         COMMENT=
         COMMENT=
```

```
        COMMENT=
        COMMENT=
        COMMENT=$$$
CHEMISTRY:
        ANALYSIS 1 BY: Q
          SIO2=25       TIO2=26       AL203=27      FE203=28       FEO=29
           MNO=30        MGO=31         CAO=32       NA20=33       K20=34
          P205=35       H20+=36       H20-=37        CO2=38      TOTAL=39
             Y=40          SR=41         ZR=42          U=43         RB=44
            TH=45          PB=46         GA=47         ZN=48         CU=49
            NI=50          CR=51          V=52         BA=53         NB=54
               $$$
        ANALYSIS 2 BY: R
          SIO2=55       TIO2=56       AL203=57      FE203=58       MNO=59
           MGO=60        CAO=61        NA20=62       K20=63       P205=64
             Y=65          SR=66         ZR=67         RB=68         BA=69
            NB=70         FEO=71
               $$$
        ANALYSIS 3 BY: S
            FE=72          K=73          NA=74         BA=75
            CO=76          CR=77         CS=78         HF=79
            MN=80          RB=81         SB=82         SR=83
            TA=84          TH=85          U=86         ZR=87
            SC=88          LA=89         CE=90         ND=91
            SM=92          EU=93         GD=94         TB=95
            DY=96          TM=97         YB=98         LU=99
            HO=100
               $$$
        RATIOS: BA/RB=101        BA/SR=102        RB/SR=103
        RATIOS:  U/TH=104         K/RB=105         K/BA=106
        COMMENT=
        COMMENT=
        COMMENT=
        COMMENT=
        COMMENT=
        COMMENT=$$$
ISOTOPES:
        ANALYSIS=K     ANALYST=L          MINERAL=M
        AGE=107                 RATIO=108
        ANALYSIS=N     ANALYST=O          MINERAL=P
        AGE=109                 RATIO=110
        ANALYSIS=      ANALYST=           MINERAL=
        AGE=                    RATIO=
        ANALYSIS=      ANALYST=           MINERAL=
        AGE=                    RATIO=
        ANALYSIS=      ANALYST=           MINERAL=
        AGE=                    RATIO=
        ANALYSIS=      ANALYST=           MINERAL=
        AGE=                    RATIO=
        COMMENT=
        COMMENT=
        COMMENT=
        COMMENT=
        COMMENT=
        COMMENT=$$$
```

LEGEND OF FIELDNAMES AND OTHER ABBREVIATIONS

TRS	township, range, and section			
cps	scintillometer counts per second			
sg	specific gravity			
ci	color index			
mag	magnetic susceptibility			
sn	stained slab:	number of	total points counted	for mode
sq	"	"	quartz	"
sp	"	"	plag	"
sa	"	"	alkali feldspar	"
sm	"	"	total mafics	"
tn	thin section:	number of	total points counted	for mode
tqpa	"	"	qtz+plag+kspar	"
tb	"	"	biotite	"
th	"	"	hornblende	"
tm	"	"	muscovite	"
tsp	"	"	sphene	"
tmg	"	"	magnetite	"
%Q1	modal	percentage of	quartz	excluding mafics
%P1	"	"	plag	"
%A1	"	"	alkali fsp	"
%Q2	modal	percentage of	quartz	including mafics
%P2	"	"	plag	"
%A2	"	"	alkali fsp	"
%M2	"	"	mafics	"

EXAMPLE OF PART OF A CARD FILE

```
SAMPLE NO=F84BU-5A
 LOCATION:
         MOUNTAIN RANGE=BULLION MTNS
         LATITUDE=341841    LONGITUDE=1155221
         QUADRANGLE=LEAD MTN
         TRS=30T3NR11E
         COMMENT=GS CHEM, =ND-50 FOR ZIRCONS (JIM WRIGHT)
         COMMENT=F84BU-5 (SAME LOCALITY) FOR K-AR, SLAB
         COMMENT=$$$
 FORMATION:
         FORMATION SYMBOL=JPQM
         COMMENT=$$$
 ROCK TYPE:
         ROCK TYPE=PORPH BIOT-QTZMONZONITE
         COMMENT=$$$
 CHEMISTRY:
         ANALYSIS 2 BY: USGS(XRF)
           SIO2=67.8     TIO2=0.60    AL203=14.7    FE203=3.60     MNO=0.05
            MGO=1.15      CAO=2.54     NA20=3.36      K20=4.54     P205=0.21
              Y=            SR=           ZR=           RB=           BA=
             NB=           FEO=
                 $$$
         COMMENT=$$$
SAMPLE NO=F84MH-61
 LOCATION:
         MOUNTAIN RANGE=MOHAVE MTNS
         LATITUDE=343405    LONGITUDE=1140735
         QUADRANGLE=BUCK MTN SE
         TRS=
         COMMENT=K-AR (HBLD), GS CHEM
         COMMENT=DEAR CYN, FIELD LOCATED ON BUCK MTN SE
         COMMENT=$$$
 FORMATION:
         FORMATION SYMBOL=T
         COMMENT=$$$
 ROCK TYPE:
         ROCK TYPE=DIORITE DIKE
         COMMENT=$$$
 CHEMISTRY:
         ANALYSIS 2 BY: USGS(XRF)
           SIO2=53.7     TIO2=1.40    AL203=14.8    FE203=8.04     MNO=0.11
            MGO=6.54      CAO=6.49     NA20=3.50      K20=2.71     P205=0.53
              Y=            SR=           ZR=           RB=           BA=
             NB=           FEO=
                 $$$
         COMMENT=$$$
```

COMMENTS ON SPECIFIC FIELDS

SAMPLE NO

Up to 20 characters. If it is in the format used by the Needles 2 Degree Project, e.g.,

BJ84CAL-248B

	BJ	84	CAL	248	B
(collector, year, mountain range, number, letter)					
max size:	2	2	3	3	2 characters

then sorting by any of the subfields can be done. For instance, sample can be placed in order by year, then by collector, then by number and letter.

LATITUDE and LONGITUDE

Give in degrees, minutes, and seconds. For instance, a latitude of 340511, or a longitude of 1154302.

TRS

Township, range, and section given as for example 30T11NR13E with the section given first, followed by township and range.

SHAWNO

This is an optional lab number for samples with Analysis 1 data analyzed by S.E. Shaw. See the following page for an explanation.

%Q1, %P1, etc.

These are mode percentages and are given in percent. See page 10 for an explanation of abbreviations.

ANALYSIS 1 BY:, ANALYSIS 2 BY:, ANALYSIS 3 BY:

This is space for the name of the person performing the chemical analysis or for the lab. Don't leave this blank if the analysis is present.

ANALYSIS 1 corresponds to the format of S.E.Shaw's analyses. ANALYSIS 2 corresponds to USGS XRF analyses. ANALYSIS 3 corresponds to USGS INAA analyses.

Oxides

Give in percent.

Trace elements

Give in ppm.

COMMENT

50 characters per line for comments, five lines in each block or subblock. These comments cannot be accessed for tables, that is, they do not have keys, but appear in option A printouts.

SOURCE

Ten lines in the LOCATION block, of 50 characters per line, for a bibliographic reference for samples taken from literature sources. Can in fact be used for any comments, and are not different from comment lines.

COMMENT=$$$

This is the block terminator and must be present at the end of each block, such as after CHARACTERISTICS. It must begin in column 11.

$$$

This is the terminator for the individual analysis sections in the CHEMISTRY block. It must begin in column 19.

NOTES ON SHAW CHEMISTRY DATA

Provision for a three digit analytical lab number for samples with Analysis 1 data is provided. It is specific to the Needles project as set up, but may be useful to others. This number is termed a SHAWNO (Shaw number) after the investigator who performed many of these analyses. Shaw samples must have a comment in the LOCATION block of the sample entry with the following format:

COMMENT=SHAWNO=XXX S

where COMMENT is a normal comment field beginning in column 11, and where XXX is a one to three digit number. Note the space between the number and the S. Other characters may follow on the same line but SHAWNO=XXX S must follow immediately after the COMMENT=. The SHAWNO can appear in any one of the LOCATION block comment lines. The SHAWNO should not appear as above unless the sample entry actually has data present in the ANALYSIS 1 block. The SHAWNO is used, if present, instead of the sample number as an identifier for TOMGNAP plots made from the Analysis 1 block if the ANALYSIS BY: field reads "S.E. Shaw".

RUNNING REFORM

REFORM is invoked by typing:

REFORM

from any directory in TFITZGIBBON's user area, or by typing:

run DISK$USERDISK:[TFITZ.ROCKS]REFORM

from anywhere on the Menlo Park ISD VAX.

A menu will appear listing several options (see page 16). Choose one of the options by typing its letter followed by a carriage return. In the example, X was typed, terminating the program.

Each of the REFORM options asks for a single input file (database card file), except for option A which needs no input file, and option D which also requires a sorted table file as input. Reform prompts for the input card file with "*Give card format infile: ". Each option produces one or more output files. After options B, C, D, or E finish running, the number of lines in the card file and the number of samples read from the card file (these should equal the number in the card file) is displayed. In addition, for option E, the number of analyses reformatted is shown. Finally, execution terminates.

If you have divided your database into several files (recommended if it is large) then you may want to concatenate those files into one large file before running REFORM. This can be done easily with the VAX/VMS COPY command. COPY CARD85.FIL, CARD86.FIL, CARD87.FIL ALL.FIL puts the contents of the three card files into the file ALL.FIL. COPY *.FIL ALL.FIL puts all files with the extension .FIL into the file ALL.FIL. Alternatively, you can run REFORM on each card file and concatenate the results.

Each of the options will be briefly described below. For detailed information go to the appropriate section (mentioned below).

THE REFORM MENU OPTIONS

A=Make a new cardfile

This is REFORM's data entry routine. See page 32, Entering and deleting data, and page 36, Modifying data.

Input file: none

Output file: new card file

B=Make a printout

Creates a nicely formatted printout of each sample entry in the file, one sample entry per page. See page 39, Printouts.

Input file: card file
Output file: printout file

C=Make a table

Makes a table of data from the fields you select to include. A table can be sorted in various ways, and then used to sort the card file it was created from by using option D. See page 44, Tables.

Input file: card file
Output file: table file

D=Sort a card file

Uses a sorted table (option C) to re-order the card file it was created from. See page 52, Tables.

Input files: card file and table file
Output file: new card file (sorted)

E=Reformat chemistry data for TOMGNAP

This option creates lines of chemical data formatted for the norm calculation and plotting program, TOMGNAP. You choose which of the analysis blocks are to be used. See page 59, Norms, for more information on this option.

Input file: card file
Output file: file of analysis cards for TOMGNAP

THE REFORM MAIN MENU

```
*run reform


This is REFORM version 2.1, a database program
 for rock sample data.

These are your choices:

    A  Make a new card file
    B  Make a printout of a card file
    C  Make a table
    D  Sort a card file
    E  Reformat chem data for TOMGNAP

    X  (exit REFORM)


*Your choice? x

FORTRAN STOP
```

ERROR HANDLING

Because the database is in one or more text files which can be created with any editor, format errors are caught only when the file is read by Reform while producing output, that is, when options B, C or E are run. Since correct positioning of columns is critical, it is best to create new entries with Reform's data entry routine, menu option A. It prompts for data, checks that an entry is not too long, and positions the field in the proper column of its line with all necessary field labels. Therefore, sample entries created with Reform A should have no format errors.

Most problems occur when correcting data or adding data to a sample entry with an editor. It is easy to shift columns, for example when replacing 65.17 with 65.7 in the SI02 field, or to accidently delete a COMMENT=$$$ line (see page 36). In addition, some fields require numbers (numeric fields), and some allow numbers or letters (alpha or character fields). Putting letters in a numeric field results in a type-mismatch error. Reform will catch format or type-mismatch errors when you run options C or E. Option B will catch format errors only.

When you run options B, C, or E any error messages generated will be displayed on the terminal screen. See below for a list of standard error messages. Typically the sample number, line number in the card file with the error, and the field in question will be displayed. Note the location and type of error from the screen if there are only a couple errors, or echo the messages to a printer if there many. Then use the VAX editor to go to those lines and correct the mistakes. Then run the Reform option again to make sure there are no additional errors.

On page 26 is a sample session of finding and correcting errors. The sample entry with errors is printed out at the top of the page. LATITUDE contains letters, a type-mismatch error, LONGITUDE is greater then 180, a factual error and thus not caught by Reform, the COMMENT=$$$ at the end of the LOCATION block is missing, a format error, and the CHARACTERISTIC SG (specific gravity) also contains letters, not numbers.

Next Reform was run and option C chosen, with no fields specified since we are only interested in locating errors. Next follow the error messages generated. The first located the missing COMMENT=$$$ at the end of the LOCATION block. The next five messages were generated because the missing COMMENT=$$$ caused the lines in the next block to be unrecognized (see the description of these two error messages). The last error message caught the "3a" is the LATITUDE field.

Now the VAX/VMS editor is used to edit the card file (not shown). The COMMENT=$$$ is added, and the LATITUDE is corrected. The corrected card file is printed out below.

Next Reform option C is run (not shown). The error in the specific gravity (SG) is found. We use the VAX editor to edit the card file. The line with error is printed out (with the type 19 command). We substitute "2.65" for the "abc", and print out the line again to check it.

Now we are all done? Running option C (not shown) produces

yet another error, a type-mismatch error, trying to convert "=" to a real number. What happened? We corrected the SG error by substituting "2.65" for "abc" with the editor. The problem is that we substituted four characters for three, thus moving the equal sign after CI into its numeric data field. Look carefully at the line before and after and note the shift. This is the most common kind of error introduced while correcting or adding data with an editor.

The solution is to delete a space before the CI using the editor. The line before and after this correction are printed below. The next run of option C found no errors.

MESSAGE:

```
XX block not properly ended before line        line #
Line reads                                     line
Sample number is                               sample
Trying to continue ...
```

where XX is Charact., Chemistry, Formation, Isotope, Location, Analysis 3, Rock type, Analysis 1, or Analysis 2.

"line #" is the line number in the card file with the error

"line" is the contents of the unexpected line

"sample" is the sample number with the error

OCCURS WHEN: When running option B, C, or E.

IF: COMMENT=$$$ is not present at the end of a block, or $$$ is not present at the end of the ANALYSIS 1, 2, and/or 3 sections, if present, in the CHEMISTRY block. Or if columns 1 thru 10 of any line that is not a block identifier contain characters.

PROGRAM ACTION: Ignores the line and reads the next one. In the case of a missing terminator, the lines in the following block will generate the error message "Unrecognized line in a XXX block ..." (see page 24). This is because the following block's identifier , that is, the unexpected line, was the line ignored and thus the following block is not recognized. In the case of random characters in the first 10 columns, the lines in the rest of the block will generate the "Unrecognized line..." error message.

YOUR ACTION: Inspect card file at the line number indicated, and add the appropriate block terminator, or delete the random characters from columns 1 through 10.

GENERATED BY: READXXXX.FOR where XXXX includes all the read routines, which are called by REFORM.FOR.

MESSAGE:

```
ANSWER TOO LONG...BY     number
          TRY AGAIN!!!!!
```

where "number" is how many characters too long

OCCURS WHEN: Running Option A
IF: Data entered is longer than the field
PROGRAM ACTION: Asks you to enter the data again.
YOUR ACTION: Re-enter the data but don't go over the field size. If it is a COMMENT field, put the extra data on the next COMMENT line, or abbreviate.
GENERATED BY: ASK.FOR which is called by: WRXXXX.FOR where XXXX is LOCA, FORM, ROCK, CHAR, CHEM, or ISOT, which are called by MAKECARD.FOR.

MESSAGE:

ERROR...array not dimensioned big enough

OCCURS WHEN: Running option D.
IF: The number of lines in the card file is more than 20,000.
PROGRAM ACTION: Stops REFORM.
YOUR ACTION: Break card file into smaller files, and sort each one individually.

GENERATED BY: SHUFFLE.FOR, which is called by REFORM.FOR.

MESSAGE:

ERROR IN OPENING filename
try again

where "filename" is the filename you just entered.

OCCURS WHEN: Running any REFORM option.
IF: Specified input or output file can't be opened.
PROGRAM ACTION: Requests that you enter the filename again.
YOUR ACTION: Make sure that you give a valid VAX filename.
GENERATED BY: GETFILE.FOR, which is called by REFORM.FOR.

MESSAGE:

ERROR trying to convert string to real number ...
string
sample= sample

where "string" is the contents of the field that generated the error

"sample" is the sample number

OCCURS WHEN: Running option C or D.

IF: String characters (letters) are present in a numeric field.
PROGRAM ACTION: Stops REFORM.
YOUR ACTION: Edit the card file, going to the sample number and field indicated, removing the letters from the field. A common problem is that adding characters to a field with an editor causes the field label of the field to the right to be shifted into that field. This will generate this error message if the field to the right is a numeric field. The solution is, when editing fields in a card file, to delete one space for each character added so no column shift occurs to the right.
GENERATED BY: RLNU.FOR which is called by FILLARRY.FOR, which is called by all OUTXXXX.FOR subroutines except OUTSAMP.FOR.

MESSAGE:

Invalid choice, try again please

OCCURS WHEN: Running option C.
IF: The key is two letters long and not DD, SS, or XX, or is one letter long and not between A and T. That is, it is not a valid key.
PROGRAM ACTION: Ignores choice and asks you to reenter your choice.
YOUR ACTION: Reenter your choice from the list of valid keys, or choose DD, SS, or XX.
GENERATED BY: GETENTRY.FOR which is called by REFORM.FOR.

MESSAGE:

Invalid choice (too long). Try again please

OCCURS WHEN: Running option C.
IF: The key is longer than 3 characters or is not a valid field key (see the list of valid field keys on page 8), or is not DD, SS, or XX.
PROGRAM ACTION: Ignores choice and asks you to reenter your choice.
YOUR ACTION: Reenter your choice from the list of valid keys, or choose DD, SS, or XX.
GENERATED BY: GETENTRY.FOR which is called by REFORM.FOR.

MESSAGE:

line reads sample number is line sample

Error trying to read in line line number
Trying to continue ...

where "line" is the contents of the line with the error

"sample" is the sample number with the error

"line number" is the line number in the card file with the error

OCCURS WHEN: Running options B, C, or E.
IF: Data error is present that was not caught by REFORM's error checking routines. This is a FORTRAN runtime error.
PROGRAM ACTION: Ignores the line, reads next line.
YOUR ACTION: Inspect card file line indicated for any format errors. If all else fails retype the line in question. It may contain an invisible control character.
GENERATED BY: BADCARD.FOR and CARDERROR.FOR which are called by READXXXX.FOR where XXXX is CHAR, CHEM, ISOT, NIAA, SHAW, or XRF, which are called by REFORM.FOR.

MESSAGE:

Too many analysis lines at line ncards

where ncards is the line number of the extra line in the card file

OCCURS WHEN: Running option B, C, or E.
IF: There are more than six analyses in the isotope block.
PROGRAM ACTION: Ignores the line, and reads the next line in the card file.
YOUR ACTION: Edit the card file at the line indicated. Delete any analyses beyond six, or place them in a second sample entry with the same sample number but with a prime, asterisk, etc., after it.
GENERATED BY: READISOT.FOR which is called by REFORM.FOR.

MESSAGE:

Too many comment lines at line ncards
Trying to continue

where "ncards" is the line number in the card file where the first extra comment line is located.

OCCURS WHEN: Running option B, C, or E.
IF: There are more than 5 comment lines in a given block.
PROGRAM ACTION: Ignores the extra line and reads the next line.
YOUR ACTION: Edit the card file at the line indicated. Delete the extra comment line(s), or put them in a different block.
GENERATED BY: NEWCMT.FOR which is called by READXXXX.FOR which represents each of the read routines.

MESSAGE:

Too many source lines at line ncards
Trying to continue

where "ncards" is the line number in the card file where the first extra source line is located.

OCCURS WHEN: Running option B, C, or E.
IF: There are more than 10 SOURCE lines in the LOCATION block.
PROGRAM ACTION: Ignores the extra line and reads the next line.
YOUR ACTION: Edit the card file at the line indicated. Delete the extra source lines, or put them in comment lines.
GENERATED BY: NEWSOURC.FOR which is called by READLOCA.FOR.

MESSAGE:

Too many texture lines at line ncards
Card reads card
Sample number is sample

where "ncards" is the line number in the card file with the first extra TEXTURE line.

"card" is the contents of the line

"sample" is the sample number with the extra TEXTURE line(s).

OCCURS WHEN: Running option B, C, or E.
IF: There are more than 4 texture lines in the ROCK TYPE block.
PROGRAM ACTION: Ignores the line and reads the next line.
YOUR ACTION: Edit the card file, and go to line number indicated. Delete the extra TEXTURE line(s), or put them in COMMENT lines.
GENERATED BY: READROCK.FOR which is called by REFORM.FOR.

MESSAGE:

Try again

OCCURS WHEN: Making a choice from the REFORM main menu or the option E menu.
IF: Your menu choice is not a valid letter.
PROGRAM ACTION: Redisplays the menu on the screen and asks for your choice again.
YOUR ACTION: Choose a valid menu option, using either upper or lower case letters, (and/or numbers for the option E menu) .
GENERATED BY: REFORM.FOR.

MESSAGE:

```
Unknown datatype at line          ncards
 after sample number              sample
Line reads:
    card
 Trying to continue ...
```

where "ncards" is the line number in the card file with the unknown line.

"sample" is the sample number with the unknown line.

"card" is the contents of the line.

OCCURS WHEN: Running option B, C, or E.
IF: Characters 2 through 5 are not one of the following: LOCA, FORM, ROCK, CHAR, CHEM, or ISOT. That is, when a valid new block does not begin following the end of the previous block.
PROGRAM ACTION: Ignores the line, and reads the next line.
YOUR ACTION: Inspect the line indicated in the card file with an editor, and correct it. Make sure that the block heading such as LOCATION: has not been moved to the right or left inadvertantly.
GENERATED BY: REFORM.FOR

MESSAGE:

```
Unrecognized line in a XXX block =     ncards
line reads          card
sample number is    sample
Trying to continue ...
```

where XXX is charact., chemistry, formation,

Analysis 1, Analysis 2, Analysis 3, location, or rock type.

"ncards" is the line number in the card file with the unrecognized card.

"card" is the contents of the line.

"sample" is the sample number with unrecognized line.

OCCURS WHEN: Running option B, C, or E.
IF: The first few characters of a line are not a valid format for that block.
PROGRAM ACTION: Ignores the line and reads the next line.
YOUR ACTION: Edit the card file. Go to the line indicated and correct or delete the unrecognized line. If this error message occurs for every line in a block and is preceded by the error message "XX block not properly ended...." (see page 19) then correct the improper block termination first and run REFORM again before dealing with this error message. This error message is generated for all lines in the block following a block without a proper termination line.
GENERATED BY: Each of the READ routines, which are called by REFORM.FOR.

MESSAGE:

You've used ncols columns which is more than 126; please start over

where "ncols" is the number of columns used up.

OCCURS WHEN: Building a table with option C.
IF: The width of the fields specified is greater than 126, the maximum width of a table.
PROGRAM ACTION: Asks you to start over building a table.
YOUR ACTION: Specify the fields desired again, but note the size of each field added from page 46, and do not go over 126 columns. If necessary divide the table into two tables with one or more common fields.
GENERATED BY: GETENTRY.FOR which is called by REFORM.FOR

SAMPLE ERROR-CORRECTING SESSION

```
SAMPLE NO=F86OW-123
 LOCATION:
         MOUNTAIN RANGE=Old Woman Mts
         LATITUDE=3abc15    LONGITUDE=1908899
         QUADRANGLE=Milligan
         TRS=
         COMMENT=Note that latitude contains letters: a type-
         COMMENT=      mismatch error.
         COMMENT=Note also that longitude is )180;  Reform doesn't
         COMMENT=      catch such factual errors.
 FORMATION:
         FORMATION SYMBOL=Kgo
         FORMATION NAME=Old Woman Granodiorite
         COMMENT=Note that the COMMENT=$$$ is missing at the end
         COMMENT=      of the LOCATION block.
         COMMENT=$$$
 CHARACTERISTICS:
         CPS=             SG=abc   CI=      MAG=
         COMMENT=Note that sg contains letters.
         COMMENT=$$$
```

```
$ run reform

This is REFORM version 2.1, a database program
 for rock sample data.

These are your choices:

    A  Make a new card file
    B  Make a printout of a card file
    C  Make a table
    D  Sort a card file
    E  Reformat chem data for TOMGNAP

    X  (exit REFORM)


*Your choice? c

*Give card format infile:  todd.2
```

```
*Give table outfile:        todd.tbl


*Expand (Needles format) sample numbers  (Y/N)? n


*Index fields (Y/N)? n

Enter a key or one of the following command keys:

          SS   start over building table
          DD   done building table, start processing
          XX   (exit to VAX system)


Choice? dd

 Location block not properly ended before line          11
 Line reads
 FORMATION:


 Sampl number is F860W-123
Trying to continue...
 Unknown datatype at line          12
  after sample number... F860W-123
 line reads:
          FORMATION SYMBOL=Kgo


 Trying to continue...
 Unknown datatype at line          13
  after sample number... F860W-123
 line reads:
          FORMATION NAME=Old Woman Granodiorite


 Trying to continue...
 Unknown datatype at line          14
  after sample number... F860W-123
 line reads:
          COMMENT=Note that the COMMENT=$$$ is missing at the end


 Trying to continue...
 Unknown datatype at line          15
  after sample number... F860W-123
 line reads:
          COMMENT=      of the LOCATION block.

 Trying to continue...
 Unknown datatype at line          16
```

```
 after sample number... F860W-123
line reads:
          COMMENT=$$$


 Trying to continue...
ERROR trying to convert string to real number...
3a
Sample= F860W-123
FORTRAN STOP
```

```
$

SAMPLE NO=F860W-123
 LOCATION:
        MOUNTAIN RANGE=Old Woman Mts
        LATITUDE=313415    LONGITUDE=1908899
        QUADRANGLE=Milligan
        TRS=
        COMMENT=Note that latitude contains letters: a type-
        COMMENT=      mismatch error.  CORRECTED

        COMMENT=Note also that longitude is )180;  Reform doesn't
        COMMENT=      catch such factual errors.
        COMMENT=$$$
 FORMATION:
        FORMATION SYMBOL=Kgo
        FORMATION NAME=Old Woman Granodiorite
        COMMENT=Note that the COMMENT=$$$ is missing at the end
        COMMENT=      of the LOCATION block.
        COMMENT=$$$
 CHARACTERISTICS:
        CPS=            SG=abc   CI=      MAG=
        COMMENT=Note that sg contains letters.
        COMMENT=$$$
```

```
$

ERROR trying to convert string to real number...
abc
Sample= F860W-123
FORTRAN STOP
```

```
*type 19

  19              CPS=          SG=abc   CI=     MAG=

*type 19

  19              CPS=          SG=2.65  CI=     MAG=



*

ERROR trying to convert string to real number...
=
Sample= F860W-123
FORTRAN STOP



$ type 19

  19              CPS=          SG=2.65  CI=     MAG=

*type 19

  19              CPS=          SG=2.65  CI=     MAG=



*

Number of cards read =            21
Number of samples read =           1
FORTRAN STOP
```

OVERALL DATABASE STRATEGY

With any large collection of important data it is a good idea to develop a general strategy to ensure accuracy and security of the data, ease of use, and lowest cost for storage and manipulation.

A database is useless if the data it contains is not correct. Use care when entering data. After correcting any format errors, make a printout of the database and carefully check it item-by-item against the original data. Tables made from the card file can be especially useful for checking data. For instance, it is easier to check latitudes and longitudes from a table of sample numbers, latitudes and longitudes than from a complete database printout of perhaps hundreds of pages. And sort the tables so they are in the most useful order.

For a large set of samples, a couple hundred or more, it is best to divide the database into several separate card files, one card file for each year or collector, for instance. Editing is much faster on smaller files.

Keep the card files in a separate directory and set protection on the files so that accidental deletions are unlikely. The card files <u>are</u> your database. They are in no way specially protected and can be deleted just like any other file unless you take steps otherwise.

Put the samples in some standard order in the card files, usually by sample number. Keep an up-to-date printout of the database on which you enter corrections and new data, to be periodically added to the card files. If you need the card files sorted in some other order, for example to assist in selecting data, use REFORM option D to make sorted <u>copies</u> and put them in a separate directory. And keep tables, TOMGNAP files, and other transient products of the database in one or more directories separate from the card files. That way you should never have to delete any files from the card file directory, only purge old card file revisions. Keep only one set of card files to avoid the problems of multiple and overlapping revisions.

Consider making or having made a magnetic backup tape of your files, particularly if you don't use the system for extended periods of time. This avoids problems if the normal system backups are lost or damaged (computer room fires have been known to happen!); keep the tape at home.

The number of files you have will increase rapidly as you create printouts, plots, tables, etc. You may quickly lose track of which file was made from what, why, and at what revision level of the card files. In addition, many of these product files are very large (e.g., TOMGNAP output files) and can add up to significant monthly storage costs. Because of all these factors, delete such files as soon as you have a hard copy, or are otherwise done with them. It will often be less expensive to recreate them each time they are needed than to store a copy of them, and they will always then be up-to-date. (However, you may wish to keep tables of data that are the result of multiple sorts and selections or other involved procedures).

There are three other ways you can keep better track of your files. Maintain a journal of changes and additions to your card files, and of what transient files (tables, etc.) are created, what they were created from, and when and why. You may also want to keep a note file in each directory describing the files it contains. Finally, use logical filenames and consistent filename extensions. For example, name card files CARD85.FIL, ANDERSON.FIL, etc. Give tables the extension .TBL, and so on.

ENTERING DATA

THREE METHODS

There three different ways of entering sample data into a reform database. These are:

1. REFORM option A
2. Any text editor
3. Punched cards

Remember that REFORM databases are simply text files in the special format required by REFORM. So to create a REFORM database you can, in principle, simply type out the data in the required format using any text editor. However, because each data field must begin in the appropriate column on each line, using an editor is not recommended (except for small additions to existing databases). Refer to page 36 on Modifying Data for instructions on how to add data using a text editor. Punched cards may also be used, but typos are also a big problem with these, and they are expensive to have made. Once the cards have been read by the computer and put into a temporary file, they can be treated just like any other card file. Punched cards will not be discussed further.

INTERACTIVE DATA ENTRY (OPTION A)

The best method is to use REFORM's interactive data entry routine, menu option A, described below. Type A from REFORM's menu. REFORM will ask you for the name of the card file to be created; type in any valid name, e.g., newcard.fil. The name should be new, not the name of an existing card file. If you want to add data to an existing card file, first create a new card file with the new samples, and then add this to the existing card file as described below.

The general sequence for entering and checking data using option A is as follows:

1. Enter data into a new card file using option A.

2. Check the new card file for accuracy by inspecting and modifying with an editor.

3. Choose option C to make a table of the new card file (see page 44 for instructions on making tables). Do not include any data fields in the table. It will only be used to check for format errors: REFORM will check for format errors while making the table and list them on the display. Note the location of each error in the card file and correct it with an editor. Run option C again and correct any further errors until no more errors are reported.

4. Add the sample entries to existing card files with an

editor, if desired. If you do this, sorting the sample entries into the same order as the entries in the existing card files, for instance by sample number, may make adding the them easier. See page 52 for instructions on sorting card files. Otherwise, the new card file is now complete, and tables, printouts, TOMGNAP files, etc., may be generated from it. See the appropriate sections in this manual for more information on these.

Option A will prompt you for the sample number and then each data field for that sample. It will display one field name at a time, followed by a series of dashes, one for each character or number in the field, so you will know how long the field is. Type in the data as you want it to appear followed by a carriage return. If you type in too many characters, you will be asked to enter the data for that field again. Make sure you enter numeric data for numeric fields; the routine won't check for this (it will be checked by other routines, such as option C described in step above). See page 8 for a list of field keys; the fields with numeric keys must contain numbers, not letters.

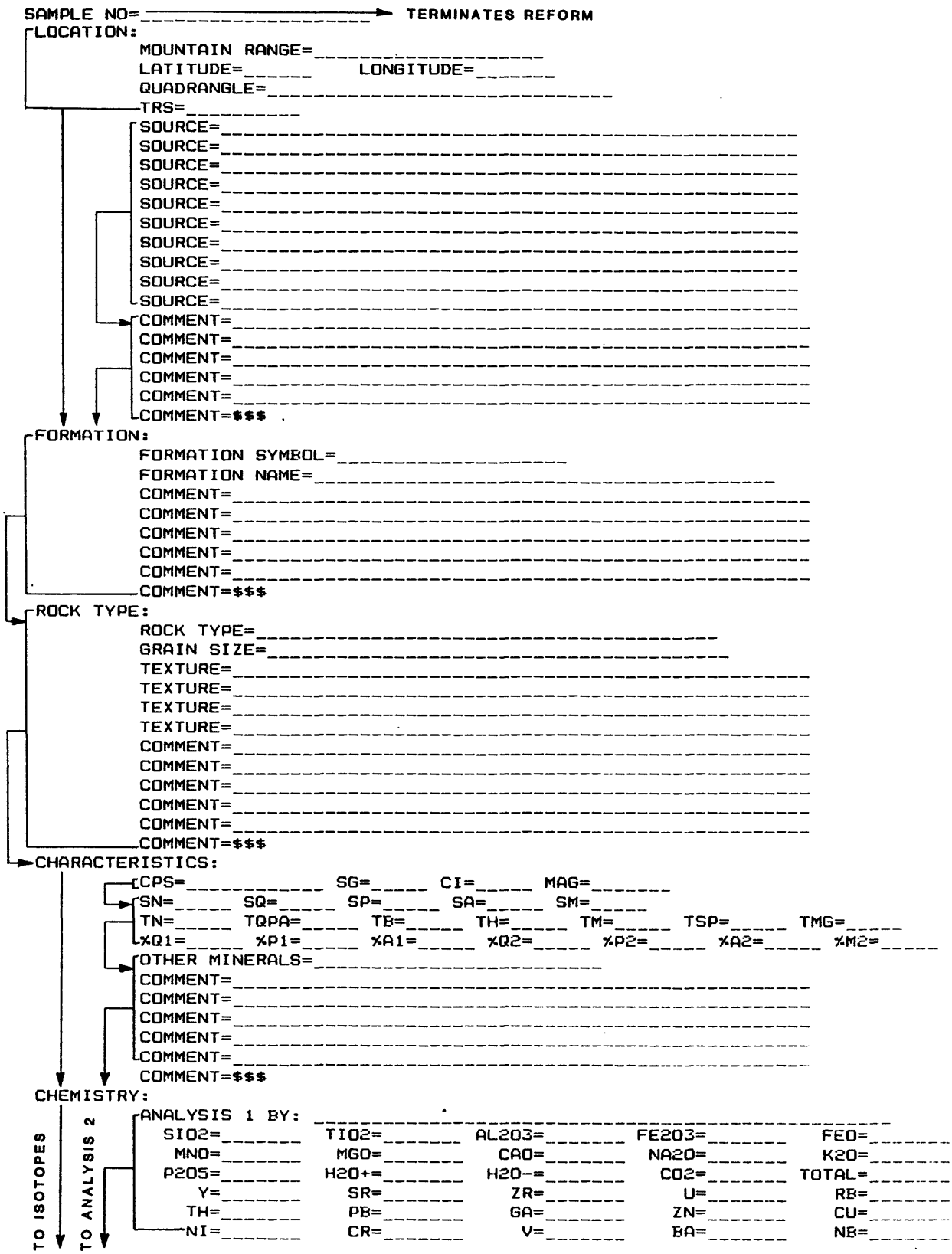
If a field name appears for which you have no data, simply type a carriage return, or a backslash if you have no more data in that block (see below). If you are missing a few scattered bits of data when you create a file with option A, enter a space for each of those fields rather than backslashing over them. That way the fieldnames will be automatically written in the correct columns by option A, and you need only insert the data with an editor when it becomes available. (See page 36 for instructions on adding data to existing card files).

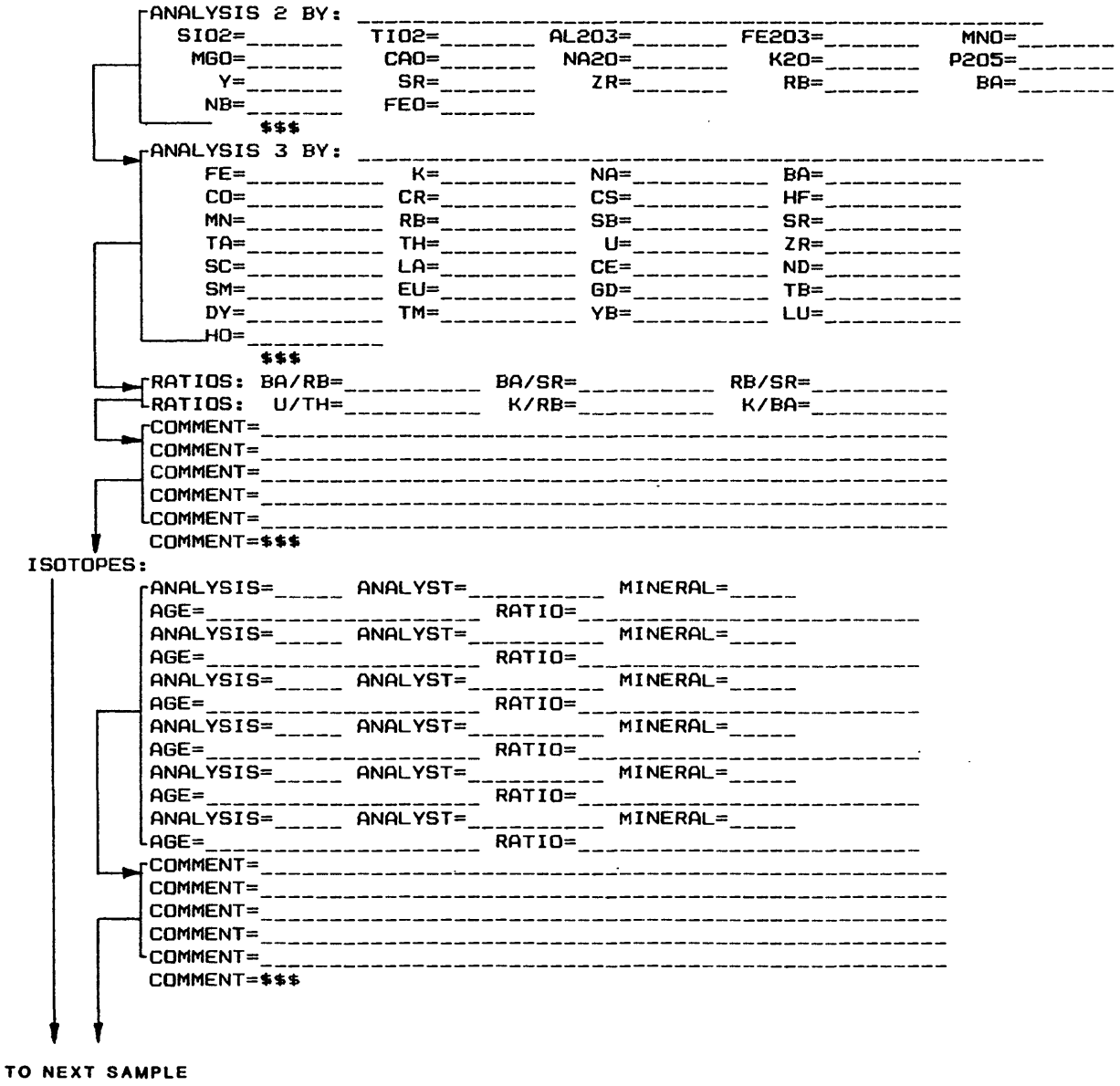
When you get to the end of the entry for the sample, you will be asked for the sample number of the next sample. Type in the new number, or type a backslash, \, if you have no more samples to enter.

You need not enter data for every possible field in every sample entry. If you have no more data in a given block, simply type a backslash to go to the next block. If you have no chemistry data at all, for example, a backslash at the beginning of the chemistry block will skip over the entire block. A sample entry need have, at a minimum, only a sample number (and some format lines that option A inserts for you). In other words, put in only the data you want. If you want to enter data only at the end of a block, you will have to enter carriage returns until you get to that point in the block since the backslash jumps you directly to the next block. See page 34 for a table of the backslash jump pattern.

Option A compacts a card file as it is created to reduce its size. It does this by deleting trailing spaces from each line. Trailing spaces are the blank spaces between the last field on a line and the end of the standard 80 character line. The savings of file storage space is often substantial.

BACKSLASH JUMP PATTERN FOR OPTION A




ANALYSIS 2 BY:
SIO2=
TIO2=
AL2O3=
FE2O3=
MNO=
MGO=
CAO=
NA2O=
K2O=
P2O5=
Y=
SR=
ZR=
RB=
BA=
NB=
FEO=
$$$
ANALYSIS 3 BY:
FE=
K=
NA=
BA=
CO=
CR=
CS=
HF=
MN=
RB=
SB=
SR=
TA=
TH=
U=
ZR=
SC=
LA=
CE=
ND=
SM=
EU=
GD=
TB=
DY=
TM=
YB=
LU=
HO=
$$$
RATIOS: BA/RB=
BA/SR=
RB/SR=
RATIOS: U/TH=
K/RB=
K/BA=
COMMENT=
COMMENT=
COMMENT=
COMMENT=
COMMENT=
COMMENT=$$$
ISOTOPES:
ANALYSIS=
ANALYST=
MINERAL=
AGE=
RATIO=
ANALYSIS=
ANALYST=
MINERAL=
AGE=
RATIO=
ANALYSIS=
ANALYST=
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ANALYSIS=
ANALYST=
MINERAL=
AGE=
RATIO=
ANALYSIS=
ANALYST=
MINERAL=
AGE=
RATIO=
ANALYSIS=
ANALYST=
MINERAL=
AGE=
RATIO=
COMMENT=
COMMENT=
COMMENT=
COMMENT=
COMMENT=
COMMENT=$$$
TO NEXT SAMPLE

MODIFYING DATA

Modifying data means making corrections, deletions, and major and minor additions to existing card files. Corrections, deletions, and minor additions are best done with an editor. The editor should have a screen mode, as does the VAX/VMS editor EDIT/EDT when used with a VT-100 compatible terminal or terminal emulation software. This speeds editing and decreases the possibility of introducing new errors. More major additions should be made in a separate file with option A, and inserted into the existing card file with an editor.

MINOR CHANGES WITH AN EDITOR

Make minor corrections and additions with an editor. Invoke the editor, specify the existing card file name, and enter screen mode. Move to the location that needs changes, make the changes, inspect them, and save the file. Delete the old version of the file. Be especially careful when editing that you don't change the column locations of fields. For instance, if you have the following line:

```
SIO2=  64.17  TIO2= 10.32 .......etc.
```

and you want to change SIO2 TO 64.7, you must insert a space so that the TIO2 column doesn't move one space to the left when you delete the 1:

```
SIO2=   64.7  TIO2= 10.32 .......etc.
                    :
not                 :
                    :
 SIO2=  64.7 TIO2= 10.32 .......etc.
```

If you are missing a few scattered bits of data when you create a file with option A, enter a space for each of those fields rather than backslashing over them. That way the fieldnames will be automatically written in the correct columns by option A, and you need only insert the data with an editor when it becomes available. However, be certain that for each character of data which you add, you delete the same number of spaces before the next fieldname to maintain column alignment.

MAJOR CHANGES WITH OPTION A AND AN EDITOR

Adding lots of data with an editor is time consuming and increases the quantity of errors. It is better to enter the new data, using option A, as one or more blocks for each sample number, then inserting the blocks into the appropriate sample entry in the existing card file using the editor's cut and paste facility.

EXAMPLE - ADDING CHEM DATA

For example, you have a card file of samples with LOCATION

and ROCK TYPE data, sorted by sample number, and just receive chemistry data for all those samples. Rather than add the chemistry data with the editor, enter it into a temporary file with option A, and add the chemistry blocks to the existing card files with the editor. The procedure is as follows:

1. Choose option A, and give a new card file name.

2. For each sample give the sample number, then backslash until you get to the chemistry block. Enter the chem data for each sample, then backslash until you are asked for the next sample number; enter a backslash when all samples are entered to terminate REFORM.

3. Check the new card file against the original data with an editor and correct as needed.

4. Run REFORM option C to make a table. Choose to expand the sample numbers if desired (see page 44 on Tables), but don't enter any other fields into the table.

5. Note and correct any errors caught by option C with an editor, and continue running option C until no more errors are reported.

6. Sort the table by sample number using the VAX SORT command (see page 49 on sorting tables).

7. Sort the new card file with REFORM option D. It is now in the same order as the existing card file.

8. Cut and paste the chemistry blocks from the new card file into the existing card file, sample-by-sample, using an editor. Delete the extra sample number from the new blocks after pasting them into the appropriate sample entry in the proper place. Check that nothing else was changed or added. In more detail, using VAX/VMS EDIT/EDT on an existing file named card86.fil, and new data in temp.fil:
    1. type edit/edt card86.fil
    2. type t 1
    3. type inc temp.fil =main This puts the new chem data at the top of the existing card file.
    4. type c and a carriage return. You are now in screen mode.
    5. goto the top of the file with the keypad top function.
    6. cut the first chem block into the paste buffer.
    7. use the keypad find function to find the same sample number in the existing sample entry below.
    8. use the cursor keys to go just beyond the CHARACTERISTICS section.
    9. paste the chem data into place.
    10. delete the extra sample number field at the start of the chem block.

11. go back to the top of the file and repeat for each sample.
12. check for added characters, typos, etc.
13. save the file.
14. run any REFORM option on the modified card file (e.g., option C, tables) to catch any format or type-mismatch errors.

Now the file is complete. This task can be speeded up with the use of EDIT/EDT macros. See the DEC VAX/VMS EDIT/EDT manual for details on use of the editor in general.

A note of caution: sometimes after pasting a block into place the line following the new block in the card file "disappears" because a carriage return is missing from the end of the block just added. Check that the next line is still in place. If not, go to the end of the last line of the new block and type a carriage return. That will bring the rest of the line down.

In summary, you've created a temporary card file with new chem data for 1986. You've sorted it so its in the same order as the existing card file to make inserting it easier. You then edit the existing card file, include the new one to the top of the file, and cut and paste the chem data, sample-by-sample, into the existing sample entries below. You checked each sample entry for errors as you went. You finally ran a REFORM option such as C (table) so REFORM could catch any format or type mismatch errors.

PRINTOUTS

Printouts of the contents of a card file can be produced in two ways. Printing the card file with the VAX system command PRINT will yield an exact image of the database. It will be in the format, line-by-line, of the card file, and therefore useful for spotting errors, but will have no page-breaks or other enhancements. REFORM option B makes a printout with one sample entry per page, and puts the data into a more readable form. This is recommended for working copies of the data base.
In the directions below, instead of printing the file on the VAX system printer, you could transfer the file to a personal computer and print it on the PC's printer.

PRINTOUTS IN THE CARD FILE FORMAT

Type print filename where filename is the name of the card file.

The printout will appear in your computer-room printout box shortly.

See the sample printout on page 40.

PRINTOUTS IN THE OPTION B FORMAT

Run REFORM, select option B, and give the name of the card file you want printed and the name of the printout file to be created. I use the name of the card file but with the extension .PRT.

After REFORM creates the printout file, type print filename where filename is the name of the printout file.

The printout will appear in your computer-room printout box shortly.

See the sample printout on page 41, and the complete option B format on pages 42 and 43.

SAMPLE PRINTOUT IN THE CARD FILE FORMAT

```
SAMPLE NO=F84BU-5A
 LOCATION:
         MOUNTAIN RANGE=BULLION MTNS
         LATITUDE=341841    LONGITUDE=1155221
         QUADRANGLE=LEAD MTN
         TRS=30T3NR11E
         COMMENT=GS CHEM, =ND-50 FOR ZIRCONS (JIM WRIGHT)
         COMMENT=F84BU-5 (SAME LOCALITY) FOR K-AR, SLAB
         COMMENT=$$$
 FORMATION:
         FORMATION SYMBOL=JPQM
         COMMENT=$$$
 ROCK TYPE:
         ROCK TYPE=PORPH BIOT-QTZMONZONITE
         COMMENT=$$$
 CHEMISTRY:
         ANALYSIS 2 BY: USGS(XRF)
           SIO2=67.8     TIO2=0.60    AL203=14.7    FE203=3.60      MNO=0.05
            MGO=1.15      CAO=2.54     NA20=3.36      K20=4.54     P205=0.21
              Y=            SR=           ZR=           RB=           BA=
             NB=           FEO=
                 $$$
         COMMENT=$$$
SAMPLE NO=F84MH-61
 LOCATION:
         MOUNTAIN RANGE=MOHAVE MTNS
         LATITUDE=343405    LONGITUDE=1140735
         QUADRANGLE=BUCK MTN SE
         TRS=
         COMMENT=K-AR (HBLD), GS CHEM
         COMMENT=DEAR CYN, FIELD LOCATED ON BUCK MTN SE
         COMMENT=$$$
 FORMATION:
         FORMATION SYMBOL=T
         COMMENT=$$$
 ROCK TYPE:
         ROCK TYPE=DIORITE DIKE
         COMMENT=$$$
 CHEMISTRY:
         ANALYSIS 2 BY: USGS(XRF)
           SIO2=53.7     TIO2=1.40    AL203=14.8    FE203=8.04      MNO=0.11
            MGO=6.54      CAO=6.49     NA20=3.50      K20=2.71     P205=0.53
              Y=            SR=           ZR=           RB=           BA=
             NB=           FEO=
                 $$$
         COMMENT=$$$
```

$$

SAMPLE: F84BU-5A   RANGE: BULLION MTNS   QUAD: LEAD MTN   TRS: 30T3NR11E

lat=34:18:41   lon=115:52:21
comment: GS CHEM =ND-50 FOR ZIRCONS (JIM WRIGHT)
comment: F84BU-5 (SAME LOCALITY) FOR K-AR, SLAB

FORMATION: symbol=JPQM   name=

ROCK TYPE: PORPH BIOT-QTZMONZONITE   grain size:

CHARACTER: cps=   sg=   ci=   mag=
slab: N: Q: P: A: M:
thin section: N: QPA: B: H: M: SP: MG:
modes: Q1: %   P1: %   A1: %   Q2: %   P2: %   A2: %   M2: %
other minerals =

CHEMISTRY:
analyzed by: USGS(XRF)

	SIO2	TIO2	AL2O3	FE2O3	MNO	MGO	CAO	NA2O	K2O	P2O5
%	67.8	0.60	14.7	3.60	0.05	1.15	2.54	3.36	4.54	0.21

	Y	SR	ZR	RB	BA	NB
ppm						

$$

SAMPLE: ________________ RANGE: ________________ QUAD: ________________________ TRS: _______
____

lat=__:__:__ lon=___:__:__
source: ____
source: ____
source: ____
source: ____
source: ____
source: ____
source: ____
source: ____
source: ____
source: ____
comment: ____
comment: ____
comment: ____
comment: ____
comment: ____

FORMATION: symbol=________________ name=________________________________
comment: ____
comment: ____
comment: ____
comment: ____
comment: ____

ROCK TYPE: ________________________________ grain size: ________________________________
texture: ____
texture: ____
texture: ____
texture: ____
comment: ____
comment: ____
comment: ____
comment: ____
comment: ____

CHARACTER: cps=_________ sg=____ ci=____ mag=_____
slab: N: ____ Q: ____ P: ____ A: ____ M: ____
thin section: N: ____ QPA: ____ B: ____ H: ____ M: ____ SP: ____ MG: ____
modes: Q1:____% P1:____% A1:____% Q2:____% P2:____% A2:____% M2:____%
other minerals = ____________________
comment: ____
comment: ____
comment: ____
comment: ____
comment: ____

CHEMISTRY:
analyzed by: ____
==

	SIO2	TIO2	AL203	FE203	FEO	MNO	MGO	CAO	NA20	K20	P205	H20+	H20-	CO2	TOTA
%															

	Y	SR	ZR	U	RB	TH	PB	GA	ZN	CU	NI	CR	V	BA	NB
ppm															

analyzed by: _____

	SIO2	TIO2	AL203	FE203	MNO	MGO	CAO	NA20	K20	P205
%										

	Y	SR	ZR	RB	BA	NB
ppm						

analyzed by: _____

	FE	K	NA
%			

	BA	CO	CR	CS	HF	MN	RB	SB	SR
ppm									

	TA	TH	U	ZR	SC	LA	CE	ND	SM
ppm									

	EU	GD	TB	DY	TM	YB	LU
ppm							

ratios:

BA/RB	BA/SR	RB/SR	U/TH	K/RB	K/BA

comment: _____
comment: _____
comment: _____
comment: _____
comment: _____

ISOTOPES:

analyst=____ analyst=_____ mineral=____ age=_____ ratio=_____
analysis=____ analyst=_____ mineral=____ age=_____ ratio=_____
analysis=____ analyst=_____ mineral=____ age=_____ ratio=_____
analysis=____ analyst=_____ mineral=____ age=_____ ratio=_____
analysis=____ analyst=_____ mineral=____ age=_____ ratio=_____
analysis=____ analyst=_____ mineral=____ age=_____ ratio=_____

comment: _____
comment: _____
comment: _____
comment: _____
comment: _____

TABLES

INTRODUCTION

REFORM can generate tables of data for specified data fields in a card file, up to a total width of 126 characters per sample. The fields can be in any order and can include alpha- and/or numeric-keyed fields (see page 8 for a list of keys).

Tables are useful ways to look at data. They can be sorted and thus present data in various ways. They can give you a list of all samples in the database, ordered any way you want. Or they can list modal data, for instance, letting you see which samples have modes completed and which don't.

Perhaps even more important is that tables of data can be used by other applications programs that perform plotting, graphing, etc. Most such programs request their input data in simple tables such as created by Option C. Examples of applications programs include Lotus Symphony on the IBM PC, and Minitab on the DEC VAX.

Both tables and the card files they were made from can be sorted by the VAX/VMS command, SORT.

REFORM has no direct method of selecting data from the database by some specified criteria: it has no query language. But data can be selected by a combination of sorts and deletions of card files and tables. Or a table with the desired data set can be transfered to a database program with a query language, such as Lotus Symphony, and data selection done there.

More details on these topics are presented below.

CREATING TABLES (OPTION C)

To create a table, run REFORM and choose option C. You will be asked a series of questions and then asked to specify which fields you want to include in the table. On pages 47 and 48 are a sample session which show you the questions, followed by the table thus created.

Sample number is always included in tables; it takes up 16 columns (plus one space as a divider). You will be asked if you want to expand the sample numbers. If all the sample numbers in the card file are in the Needles Project format (see page 12) they may be expanded into their subfields so that the table or card file it was made from can be sorted by those subfields, e.g., by year and/or by geologist's initials. The expansion is necessary because VAX SORT only deals with data aligned in vertically in columns.

The index fields give the starting line number of the sample entry in the card file, and the number of lines in the sample entry. They should be included if you want to use option D to sort the card file the table was made from (see page 52). The index fields take up 5 spaces each plus a space after each as a divider.

You specify the fields you want included in the table by their keys, listed on page 8. The length of the fields as they

will appear in the table will not necessarily be the same as their lengths in the actual database. For instance, ROCK TYPE can be up to 40 characters long in a card file, but is truncated to 20 characters in a table. This is a compromise to allow more fields on the 126 column table line, and because, often, only the first few characters in a long field are used in the card file.

See page 46 for a list of the field lengths as they will appear in tables. The formats are listed as alpha or numeric FORTRAN formats, for the alpha and numeric keys, respectively. A16 means 16 alpha characters. F5.2 means 5 places overall: 2 to the right of the decimal point (the .2 part of the format), one for decimal point, and the rest (here also 2) to the left of the decimal point. (F stands for floating point real numbers). In addition, there is one space added between each field to aid readability.

LIST OF FIELD FORMATS FOR TABLES

KEY	FORMAT	KEY	FORMAT	KEY	FORMAT
A	A16	25	F5.2	69	F5.0
B	A10	26	F4.2	70	F5.0
C	A15	27	F5.2	71	F5.2
D	A10	28	F5.2	72	F6.3
E	A15	29	F5.2	73	F6.3
F	A20	30	F3.2	74	F6.3
G	A20	31	F5.2	75	F9.4
H	A20	32	F5.2	76	F9.4
I	A8	33	F5.2	77	F9.4
J	A20	34	F5.2	78	F9.4
K	A5	35	F4.2	79	F9.4
L	A10	36	F5.2	80	F9.4
M	A5	37	F5.2	81	F9.4
N	A5	38	F5.2	82	F9.4
O	A10	39	F6.2	83	F9.4
P	A5	40	F5.0	84	F9.4
Q	A20	41	F5.0	85	F9.4
R	A20	42	F5.0	86	F9.4
S	A20	43	F5.0	87	F9.4
T	A3	44	F5.0	88	F9.4
1	F7.4	45	F5.0	89	F9.4
2	F8.4	46	F5.0	90	F9.4
3	F6.4	47	F5.0	91	F9.4
4	F4.1	48	F5.0	92	F9.4
5	F7.4	49	F5.0	93	F9.4
6	F5.0	50	F5.0	94	F9.4
7	F5.0	51	F5.0	95	F9.4
8	F5.0	52	F5.0	96	F9.4
9	F5.0	53	F5.0	97	F9.4
10	F5.0	54	F5.0	98	F9.4
11	F5.0	55	F5.2	99	F9.4
12	F5.0	56	F5.2	100	F9.4
13	F5.0	57	F5.2	101	F8.4
14	F5.0	58	F5.2	102	F8.4
15	F5.0	59	F5.3	103	F8.4
16	F5.0	60	F5.2	104	F8.4
17	F5.0	61	F5.2	105	F9.3
18	F5.1	62	F5.2	106	F9.3
19	F5.1	63	F5.2	107	F7.2
20	F5.1	64	F5.2	108	F8.4
21	F5.1	65	F5.0	109	F7.2
22	F5.1	66	F5.0	110	F8.4
23	F5.1	67	F5.0		
24	F5.1	68	F6.1		

SAMPLE SESSION OF CREATING A TABLE WITH OPTION C

```
$ run reform


This is REFORM version 2.1, a database program
 for rock sample data.

These are your choices:

    A  Make a new card file
    B  Make a printout of a card file
    C  Make a table
    D  Sort a card file
    E  Reformat chem data for TOMGNAP

    X  (exit REFORM)


*Your choice? c

*Give card format infile:  [tfitz.moj.database]card85.fil

*Give table outfile:       card85.tbl


*Expand (Needles format) sample numbers  (Y/N)? y


*Index fields (Y/N)? y


Enter a key or one of the following command keys:


          SS   start over building table
          DD   done building table, start processing
          XX   (exit to VAX system)


Choice? b

Your choices so far are:   B
Columns used up so far =           40

          SS   start over building table
          DD   done building table, start processing
          XX   (exit to VAX system)


Choice? c

Your choices so far are:   B  C
Columns used up so far =           56

          SS   start over building table
          DD   done building table, start processing
          XX   (exit to VAX system)
```

```
Choice? 18

Your choices so far are:    B  C 18
Columns used up so far =            62

          SS   start over building table
          DD   done building table, start processing
          XX   (exit to VAX system)


Choice? 19

Your choices so far are:    B  C 18 19
Columns used up so far =            68

          SS   start over building table
          DD   done building table, start processing
          XX   (exit to VAX system)


Choice? 25

Your choices so far are:    B  C 18 19 25
Columns used up so far =            74

          SS   start over building table
          DD   done building table, start processing
          XX   (exit to VAX system)


Choice? dd

Number of cards read =          236
Number of samples read =         10
FORTRAN STOP
```

EXAMPLE OF A TABLE

```
$ type card85.tbl

   1   23   H 85 BLD   1     BOULDER CI                  14.4  39.7  0.00
  24   23   H 85  PN  20     PINTO MTNS VALLEY MTN       35.4  29.4  0.00
  47   24   H 85  HU  43     HUALAPAI M GUNSIGHT CANYON  29.1  52.1  0.00
  71   24   H 85  HU  43  A  HUALAPAI M GUNSIGHT CYN 7   24.4  49.2  0.00
  95   24   H 85  HU  44     HUALAPAI M GUNSIGHT CANYON  28.0  48.5  0.00
 119   23   H 85  HU  46     HUALAPAI M KINGMAN          33.5  37.8  0.00
 142   24   H 85  HU  47     HUALAPAI M KINGMAN          34.2  36.4  0.00
 166   25   H 85  DM  64     DEAD MTNS  BANNOCK          17.9  51.9  0.00
 191   21   H 85  DM  66     DEAD MTNS  BANNOCK          23.6  62.5  0.00
 212   24   H 85  DM  68     DEAD MTNS  BANNOCK          25.2  45.6  0.00
```

SORTING TABLES

You can sort your tables with the VAX SORT command. See the section on SORT in the DEC VAX/VMS Command Language User's Guide. You may also transfer your table to a database program such as Lotus Symphony on a PC, and use that program's sort facility. The VAX SORT command is more powerful, however. See Page 55 for information on using tables with programs on PC's.

When you execute SORT you give the sort keys: the fields you want the file sorted on (see the example below). These are specified by giving the column number in the table that the field starts in and the number of columns or characters in the field. There can be more than one sort key. For example, you could sort by quadrangle, and for each quad put the samples in order by latitude. So you would specify the column number that the quad field starts in in the table, and how many columns are in the field. This is the first sort key. Then do the same for latitude. Then you will be prompted for the input file: your table, and for the name you want to give the output file: I use the extension .SRT to indicate that it is sorted.

For commonly performed sorts it is most convenient to create a command file to perform the sort automatically. Two such "coms" are printed on page 50. To execute a com, type @ followed by the name of the com. The extension .COM is not necessary. For example, to execute lsort.com, type @lsort. You must execute the com from the directory it is in, or give its full pathname. Use these coms as is, or use them as models to create other similar coms.

Each com assumes a certain table format and sorts it in a predefined manner. They prompt for the names of the input and output files and then perform the sort.

TSORT.COM sorts a table that includes index fields, expanded sample numbers, and any other fields. It sorts by the sample number subfields: year, geologist, number, and letter. This is useful for getting new card files in a standard order.

LSORT.COM sorts a table that has expanded sample numbers, quadrangle, latitude, and longitude fields, in that order, and no index fields. It sorts by quad, and for each quad, by year, geologist, number, and letter.

Each field in a table has a specific size. The number of columns taken up by a given field is the length of the table format for that field (page 46), plus one (for a space between columns).

An example of sorting a table is on page 51. The table at the top of the page was built from card85.fil using REFORM option C and specifying the MOUNTAIN RANGE, QUADRANGLE, %Q1, %P1, and SIO2 fields, plus the expanded SAMPLE NUMBER and index fields. Note that there is no data for SIO2.

Next the VAX SORT command is given. The starting column position and field size for the MOUNTAIN RANGE and %Q1 fields is given as shown. A hyphen is typed at the end of the first line and return pressed. The next line is then entered followed by a return. You are then prompted for the input and output files. The sorted file is printed at the bottom of the page. It is now sorted by MOUNTAIN RANGE, and for each MOUNTAIN RANGE, by %Q1.

SORT COMS

LSORT.COM

Use this on a table with expanded sample numbers, quadrangle, latitude, and longitude fields, in that order.

```
$
$     !  Sorts a table file created by reform/outtable
$     !  according to quad and sample number fields:
$     !    year,geologist,number,letter
$
$     text="Sort a lat/lon file by quad and sample number"
$     write sys$output text
$        inquire p1 "input file"
$     inquire p2 "output file"
$
$     sort/key=(position:18,size:10)-
          /key=(position:4,size:2)-
          /key=(position:1,size:2)-
             /key=(position:11,size:3)-
             /key=(position:15,size:2)-
              'p1' 'p2'
$
$     exit
```

TSORT.COM

Use this on any table that has index fields included and an expanded sample number.

```
$
$     !  Sorts a table file created by reform/outtable
$     !  according to sample number fields:
$     !    year,geologist,number,letter
$
$     text="Sort a table file by sample number"
$     write sys$output text
$        inquire p1 "input file"
$     inquire p2 "output file"
$
$     sort/key=(position:16,size:2)-
          /key=(position:13,size:2)-
             /key=(position:23,size:3)-
             /key=(position:27,size:2)-
              'p1' 'p2'
$
$     exit
```

EXAMPLE OF SORTING A TABLE

```
$ type card85.tbl

   1   23   H 85 BLD   1     BOULDER CI                  14.4  39.7  0.00
  24   23   H 85  PN  20     PINTO MTNS VALLEY MTN       35.4  29.4  0.00
  47   24   H 85  HU  43     HUALAPAI M GUNSIGHT CANYON  29.1  52.1  0.00
  71   24   H 85  HU  43   A HUALAPAI M GUNSIGHT CYN 7    24.4  49.2  0.00
  95   24   H 85  HU  44     HUALAPAI M GUNSIGHT CANYON  28.0  48.5  0.00
 119   23   H 85  HU  46     HUALAPAI M KINGMAN          33.5  37.8  0.00
 142   24   H 85  HU  47     HUALAPAI M KINGMAN          34.2  36.4  0.00
 166   25   H 85  DM  64     DEAD MTNS  BANNOCK          17.9  51.9  0.00
 191   21   H 85  DM  66     DEAD MTNS  BANNOCK          23.6  62.5  0.00
 212   24   H 85  DM  68     DEAD MTNS  BANNOCK          25.2  45.6  0.00
```

```
$ sort/key=(position:29,size:10)-
_$ /key=(position:56,size:6)
_Input: card85.tbl
_Output: card85.srt
```

```
$ type card85.srt

   1   23   H 85 BLD   1     BOULDER CI                  14.4  39.7  0.00
 166   25   H 85  DM  64     DEAD MTNS  BANNOCK          17.9  51.9  0.00
 191   21   H 85  DM  66     DEAD MTNS  BANNOCK          23.6  62.5  0.00
 212   24   H 85  DM  68     DEAD MTNS  BANNOCK          25.2  45.6  0.00
  71   24   H 85  HU  43   A HUALAPAI M GUNSIGHT CYN 7    24.4  49.2  0.00
  95   24   H 85  HU  44     HUALAPAI M GUNSIGHT CANYON  28.0  48.5  0.00
  47   24   H 85  HU  43     HUALAPAI M GUNSIGHT CANYON  29.1  52.1  0.00
 119   23   H 85  HU  46     HUALAPAI M KINGMAN          33.5  37.8  0.00
 142   24   H 85  HU  47     HUALAPAI M KINGMAN          34.2  36.4  0.00
  24   23   H 85  PN  20     PINTO MTNS VALLEY MTN       35.4  29.4  0.00
```

SORTING CARD FILES (OPTION D)

The card files that make up your database are most easily used when the sample entries in them are in a meaningful order. You might want to initially sort a newly created card file by sample number, or you might want to re-sort an existing cardfile by other parameters such as SIO2 weight percent.

To sort a card file:

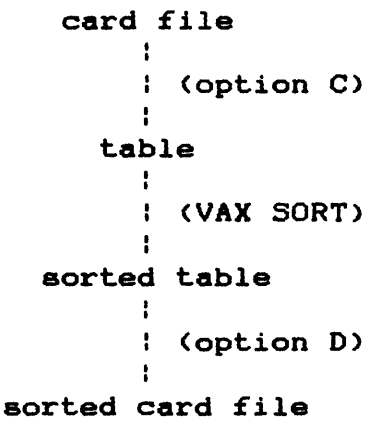
1. Run REFORM and choose option C. The sample number is automatically included in the table; if it is in Needles Project format you may want to expand it. Include index fields in the table. Specify any other fields you want to sort on.
2. Sort the table in the desired order with the VAX SORT command, as described on page 49.
3. Run REFORM and choose option D. Specify the name of the sorted table and of the card file you wish to sort. The card file will be sorted into the same order as the table.

A flowchart of this process is on the next page.

Option D doesn't modify the original card file, it makes a copy in the new order. Don't make any changes in the original card file between the time you make the table and when you sort the card file because the line numbers are used in the sorting process.

Option D also deletes blank lines and blank spaces at the end of each line as it reads in the card file, in order to decrease file size and thus storage costs.

FLOW CHART FOR SORTING A CARD FILE



The four files you end up with at the end of the process are:

The original card file, untouched.
The unsorted table made from the card file.
The sorted version of the table.
A sorted version of the card file.

SELECTING DATA

REFORM has no direct method of selecting data from card files by some specified criteria. Standard database packages include what is called a query language that allows you to ask for, for example, all samples with SIO2>65% and formation symbol="K" (Cretaceous). REFORM doesn't have a query language, but data can be selected in one of two ways. You could, using the above example, sort a copy of the card file by SIO2%, then delete all sample entries below 65%. Then sort what is left by formation symbol, deleting all but the block with "K". Tables may be handled in the same way if only a few fields rather then the entire sample entry are needed. A second method is to make a table of the fields of interest, load it into a standard database program, such as Lotus Symphony on a PC, and use its query language to select the data you want. This method will be discussed in the next section. The procedure for selecting data using sorts and deletions of card files is summarized below for two examples.

Want: all sample entries in a card file with 65< SIO2 <75 and of Jurassic age.

1. make a table that includes index fields and SIO2%.
2. sort the table on SIO2%.
3. sort the card file using the table.
4. delete sample entries in the sorted card file with <65 and >75% SIO2. Use block deletes with an editor.
5. make a table from the modified card file that includes index fields and FORMATION SYMBOL.
6. sort the table on FORMATION SYMBOL.
7. sort the modified card file using the table.
8. delete sample entries in the sorted card file that don't have "J" in their FORMATION SYMBOL.

Want: all samples present in a table made from a card file that have 65< SIO2 <75 or Jurassic.

1. make a table from the card file including SIO2, FORMATION SYMBOL, and any other fields of interest.
2. make a second copy of the table.
3. sort one copy by SIO2%.
4. delete all samples outside the desired SIO2% range.
5. sort the other table by FORMATION SYMBOL.
6. delete all samples that don't have "J" in their FORMATION SYMBOL.
7. concatenate the tables with an editor.
8. sort the tables by sample number.
9. delete duplicate sample numbers.

USING TABLES WITH OTHER PROGRAMS

Tables of data made from card files may be transfered to other programs for further analysis and display. Examples of such programs are:

Lotus 1-2-3 and Symphony for IBM PC compatibles. These are "integrated" programs that allows data manipulation, sorting, selection, and graphing.

dBASEII, III, and III Plus, by Ashton Tate, for IBM PC compatibles. Database programs. No built-in graphics.

MINITAB for the DEC VAX or IBM PC compatibles. A data manipulation, statistical analysis, and plotting program.

ISM for the DEC VAX. Interactive Surface Modeling. Makes map-based plots and block diagrams.

GPP for IBM PC compatibles. Geochemical Program Package. Makes X-Y, ternary, and normalized REE plots, in addition to norms and other calculations.

To transfer data to any of these programs, first make a table with the appropriate data using option C. Most of these programs expect the data to be in columns and rows, with an item of data for every cell, or the data to be delimited by commas or some other character. Some programs, including Symphony, expect character strings to be enclosed in double quotation marks (or they will be ignored). If the table has no blank entries, then there should be no problem transfering numeric data, at least. If some data entries are blank, the program may misinterpret the following data entry for the field that had no data. To correct this, you may wish to write a short program to insert zeroes in the blank fields in your table, or add delimiters. This program will be specific to the exact format of the table since it will assume that the data entries start in specific columns. If you are transfering the table to a program such as Symphony that has spreadsheet capabilities, and the data set is not large, you can manually edit the data once it is transfered. Or you may edit the table with a text editor.

Some of these programs require that data files not created by them be loaded as foreign files. See the manual of the particular program.

EXAMPLE: LOTUS SYMPHONY

Tables created by REFORM may be loaded into a Symphony worksheet without modification by using the following procedure. This makes use of the File Import and Query Parse commands, and both SHEET and FORM environments. An example will be given. Note that both numeric and character (alpha) fields can be handled. Empty fields cause no problems.(This example uses

Symphony release 1.01).

1. Create the table with REFORM option C, noting the fields you included. Next, record the size of each field by adding 1 to the appropriate sizes listed in the Table Formats list on page 46 of this manual. For the example, a table was created from a card file with ten samples, using the following fields.

KEY	FIELD	SIZE (from Table Formats, plus 1)
A	Sample Number	17
B	Mountain Range	11
C	Quadrangle	16
18	Q1	6
19	P1	6
20	A1	6

The table is reproduced below:

H	85	BLD	1		BOULDER CI	14.4	39.7	45.9
H	85	PN	20		PINTO MTNS VALLEY MTN	35.4	29.4	35.2
H	85	HU	43		HUALAPAI M GUNSIGHT CANYON	29.1	52.1	18.9
H	85	HU	43	A	HUALAPAI M GUNSIGHT CYN 7	24.4	49.2	28.1
H	85	HU	44		HUALAPAI M GUNSIGHT CANYON	28.0	48.5	23.5
H	85	HU	46		HUALAPAI M KINGMAN	33.5	37.8	28.8
H	85	HU	47		HUALAPAI M KINGMAN	34.2	36.4	29.4
H	85	DM	64		DEAD MTNS BANNOCK	17.9	51.9	30.2
H	85	DM	66		DEAD MTNS BANNOCK	23.6	62.5	13.9
H	85	DM	68		DEAD MTNS BANNOCK	25.2	45.6	29.1

2. Transfer the table to your PC using a communications program such as Kermit or PC-TALK, or Symphony's COMM facility.

3. Run Symphony, and use the default SHEET window.

4. On row 1 of the worksheet, enter names for each of the fields (making each name no longer than the length of its field) followed by L or N, depending whether the field is letters or numbers, followed by the size of the field. Enter one field per worksheet cell. Don't forget the colons. In our example this would be as shown below (also see row 1 of the worksheet on page 58):

CELL:	A1	B1	C1	D1	E1	F1
Sample No:L:17	Range:L:11	Quad:L:16	Q1:N:6	P1:N:6	A1:N:6	

This sets up the format for the database. Note that we could have chosen to define the Sample Number as several fields since it is expanded. That would have allowed sorting on its sub-keys.

5. Use the TYPE function key to change to the FORMS work

environment.

6. Use the MENU function key, choose GENERATE, and choose the default settings offered: labels, and width of 9. Enter a name for the database such TABLE. Next Symphony returns you to the SHEET environment where you highlight the range of fieldnames, here cells A1..F1.

7. You will be returned to the FORM environment. Use the MENU function key, and select SETTINGS, BASIC, then DATABASE. You will be returned to the SHEET environment where you will see the database housekeeping entries GENERATE created for you. In the example printout on page 58, you created row 1, and GENERATE created rows 2 through 26. You may ignore all these entries. Your cursor will be in cell A27, the start of the database range. You should move the cursor down to define the range of the database; it should be at least two times as long as your table. In our example, this would be through row 50.

8. Return to the SHEET environment with the TYPE key. Position the cursor in the first row of the database range, here cell A27.

9. Choose SERVICES, FILE, IMPORT, TEXT, and give the name of the table you created with REFORM and transfered to your PC. The table will appear starting at the cursor.

10. Choose MENU, QUERY, PARSE. Highlight the entire table, here A27..F36. For the REVIEW range, put the cursor a line or two below the table. Press RETURN and cross your fingers. If some lines didn't conform to the format entered in step 3 above, they will appear in the REVIEW range, where you may edit or delete them. See the Symphony manuals for more information if this occurs. The parsed table will appear below the database range, rows 51 through 60 in the example. Page 58 shows the state of the database (in the SHEET environment) after this step was performed.

11. Use the SERVICES key to return to the FORM environment. Use the DELETE key to delete the database records of the original table (note that only the first field of each record shows up in the entry form), and the blank records above the parsed table. This causes rows 27 through 50 in our example to be deleted, and the parsed table originally in rows 51 through 60 to move up to rows 27 through 36. (Don't delete these rows in the SHEET environment with the MENU DELETE ROW command; delete them in the FORM environment with the DEL key.)

12. Now save the database, and perform any of the various Symphony functions available, including printing reports, sorting records, selecting records, etc.

LOTUS SYMPHONY DATABASE SCREEN IN SHEET MODE

```
A1: 'Sample No:L:17                                                           SHEET

             A               B              C           D      E      F
1   Sample No:L:17    Range:L:11  Quad:L:16         Q1:N:6 P1:N:6 A1:N:6
2
3   Sample No _________________
4   Range ___________
5   Quad ________________
6   Q1 ______
7   P1 ______
8   A1 ______
9
10  Name                 Value       Type           DefaultFormulaValidit
11  Sample No             H 85   DM   6L:17
12  Range                DEAD MTNS    L:11
13  Quad                 BANNOCK      L:16
14  Q1                          25.2 N:6
15  P1                          45.6 N:6
16  A1                          29.1 N:6
17
18  Sample No            Range       Quad            Q1      P1      A1
19   H 85 BLD    1      B          0              0       0       0       0
20
21  Sample No            Range       Quad            Q1      P1      A1
22
23
24
25
26  Sample No            Range       Quad            Q1      P1      A1
27   H 85 BLD    1      BOULDER CI                14.4   39.7   45.9
28   H 85   PN   20     PINTO MTNS VALLEY MTN     35.4   29.4   35.2
29   H 85   HU   43     HUALAPAI M GUNSIGHT CANYON 29.1  52.1   18.9
30   H 85   HU   43   A HUALAPAI M GUNSIGHT CYN 7  24.4  49.2   28.1
31   H 85   HU   44     HUALAPAI M GUNSIGHT CANYON 28.0  48.5   23.5
32   H 85   HU   46     HUALAPAI M KINGMAN        33.5   37.8   28.8
33   H 85   HU   47     HUALAPAI M KINGMAN        34.2   36.4   29.4
34   H 85   DM   64     DEAD MTNS  BANNOCK        17.9   51.9   30.2
35   H 85   DM   66     DEAD MTNS  BANNOCK        23.6   62.5   13.9
36   H 85   DM   68     DEAD MTNS  BANNOCK        25.2   45.6   29.1
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51   H 85 BLD    1       BOULDER CI                    14.4    39.7    45.9
52   H 85   PN   20      PINTO MTNS   VALLEY MTN       35.4    29.4    35.2
53   H 85   HU   43      HUALAPAI M   GUNSIGHT CANYON  29.1    52.1    18.9
54   H 85   HU   43   A  HUALAPAI M   GUNSIGHT CYN 7   24.4    49.2    28.1
55   H 85   HU   44      HUALAPAI M   GUNSIGHT CANYON    28    48.5    23.5
56   H 85   HU   46      HUALAPAI M   KINGMAN          33.5    37.8    28.8
57   H 85   HU   47      HUALAPAI M   KINGMAN          34.2    36.4    29.4
58   H 85   DM   64      DEAD MTNS    BANNOCK          17.9    51.9    30.2
59   H 85   DM   66      DEAD MTNS    BANNOCK          23.6    62.5    13.9
60   H 85   DM   68      DEAD MTNS    BANNOCK          25.2    45.6    29.1
                                                                           MAIN
02-Oct-86   04:58 PM               OnLine
```

NORMS AND PLOTS WITH TOMGNAP (Option E)

INTRODUCTION

REFORM has three options that format chemistry data from card files for TOMGNAP, a norm calculation and plotting program. GNAP stands for Graphic Normative Analusis Program. TOMGNAP is an extended version of GNAP by Tom Wright and Sam Priebe of the USGS. The reference manual for GNAP is:

> Stuckless, J.S., and VanTrump, Jr., G., 1979, A revised version of Graphic Normative Analysis Program (GNAP) with examples of petrologic problem solving: U.S. Geological Survey Open-File Report 79-1237, 51 p.

GNAP and TOMGNAP calculate mineral norms given oxide data in percent. They can print out a page of norm and other data for each sample, make X-Y and ternary plots, print tables of various parameters, and convert values to mole percent for molar calculations. Plots can be produced on either a line printer or a plotter. TOMGNAP adds the capability to handle trace element data in a user-defined format.

REFORM OPERATION

REFORM OPTIONS FOR TOMGNAP

REFORM has three options that reformat card file chemistry data for TOMGNAP. These options are obtained by first choosing option E from the main REFORM menu. The option E menu will then be displayed listing the TOMGNAP options. See page 61 for the REFORM option E menu.

Option 1: Reformats data from the Analysis 1 block. For the data in the block to be reformatted the ANALYSIS 1 BY: field must be present although the field itself may be blank. If the field contains "S.E. Shaw" then the identifier for that sample will be the SHAWNO if present rather than the sample number (see page 13 for information on SHAWNO's).

Option 2: REFORMats data from the Analysis 2 block. For the data in the block to be reformatted the ANALYSIS 2 BY: field must be present although the field itself may be blank.

Option 3: Reformats data from the Analysis 3 block and combines it with part of the data from the Analysis 1 block. For the data to be reformatted the ANALYSIS 3 BY: field must be present although the field itself may be blank. The Analysis 3 block contains INAA analysis data for trace and rare earth elements. Combining this with major element data from Analysis 1 permits plotting those elements against oxides. The fields used from the Analysis 1 block are number 25 through 44 except 39 which is the total. (Standard normalized REE plots may be obtained by specifying the appropriate fields for a table, and

using this with a program that does these plots, such as GPP).

A sample entry can have at most one of each of the analysis blocks. Additional analyses of the same type for a single sample must either be averaged and put in one block, put in comment lines (where they are not accessible by the TOMGNAP options), or put in a separate sample entry, with the sample number "primed", etc. Each REFORM TOMGNAP option reformats one or more analysis block from each sample. The routine reads the chemistry data from the appropriate block or blocks, formats it for TOMGNAP, and places it in a new file. Each sample gets up to three lines of chem data, called analysis cards. Then TOMGNAP commands are added to this file with an editor, TOMGNAP is run, producing a printout or plot file, and the file printed or plotted (see flow chart on page 62).

GNAP and TOMGNAP require that all analysis cards in a given input file have the same format. Thus you can't run option 1 on one file, option 3 on another, and put the analysis cards together for a single TOMGNAP run. However, the analysis cards generated by option 1 from Analysis 1 are compatible with those created by option 2 from Analysis 2 and can be mixed later with an editor.

These REFORM options prompt for a plot symbol. This is a single printable character that is used to plot each point. You can specify the same character for all the samples, or let REFORM assign a unique character to each sample. REFORM assigns upper case letters to the first 26 samples, lower case to the next 26, punctuation marks and numbers to the next 31 (ASCII characters 33 through 63), and "@" for all further samples, that is, those beyond 83. Note that some plotters cannot plot lower case characters. You can assign a single character to groups of samples later by editing the analysis card file.

TOMGNAP uses an 8 character identifier for each sample. REFORM supplies the last 8 digits of the sample number unless a SHAWNO is used (see above).

X-Y and ternary plots done on the line printer have a precision of one character width since the printer prints in fixed columns. If two or more symbols would overprint the first one is printed and underlined. Plots done on the plotter have high precision, and overlapping symbols are plotted in their precise positions

```
$ run reform


This is REFORM version 2.1, a database program
 for rock sample data.

These are your choices:

    A  Make a new card file
    B  Make a printout of a card file
    C  Make a table
    D  Sort a card file
    E  Reformat chem data for TOMGNAP

    X  (exit REFORM)


*Your choice? e

*Give card format infile:  test.fil


This is the Reform option E menu.

The following routines reformat data for TOMGNAP.

You may choose to reformat data from:

    1  Analysis 1
    2  Analysis 2
    3  Analyses 3 and 1 combined

    X  (exit REFORM)


*Your choice? (1,2,3,or X): 1

*Give tomgnap outfile:     test.gnp

 You may specify a plotting symbol;  otherwise a unique
 plotting symbol will be assigned to each sample:

*Do you want to specify a plotting symbol (Y/N) ? y

*Give plotting symbol (1 char): *

Number of analysis samples read =            1
Number of cards read =           43
Number of samples read =            1
FORTRAN STOP
```

FLOW CHART FOR USING REFORM WITH TOMGNAP

Assemble together entries for samples you want norms of. [From one or more card files, sorted if desired.]

↓

Run REFORM options 1, 2, or 3.
[Creates a file of analysis cards (lines of chem data) formatted for TOMGNAP.]

↓

Sort the analysis cards further if desired.
[It is easier to do manual sorting of the analysis cards than of the sample entries. E.g., if you want some special order not possible with VAX SORT.]

↓

Combine the analysis card file with the appropriate boilerplate GNAP or TOMGNAP command file using an editor.

↓

Add or delete commands as necessary. Modify dummy values if necessary for proper scaling.

↓

Run TOMGNAP.

↓

Check that the program ran properly.
[Look at the printer or plot file produced by TOMGNAP: check for error messages at the end of the file, that norms and plots are OK, scales right, etc. A "Divide by zero" error message at the end of the file is OK. Also look for a Fortran error file in your directory; if present it will list any error conditions. Correct any errors with an editor. A common error is to forget the semicolon at the end of each command.

↓

Have the file printed or plotted.

↓

Delete the plot or printout file.
[These files are very large. It is cheaper to save the command file and run TOMGNAP each time a new printout is needed.

TOMGNAP OPERATION

TOMGNAP is executed simply by typing its name when in any directory in TFITZGIBBON's user area:

tomgnap

or by typing the following from any area on the ISD VAX:

run dra0:[userprog]tomgnap

TOMGNAP requests the name of the input commands file. This file includes any plot, format, and calculation commands, as well as the analysis cards produced by REFORM, and is assembled by you using an editor. It is recommended that you keep boilerplate command files containing basic commands and dummy plot scaling values (see below). A sample command file appropriate for analysis cards produced by TOMGNAP options 1 and 2 is listed starting on page 65. Use this file as a model. It lists many, many commands; commands not needed may be deleted, and other commands may be added. At a minimum, a GNAP input command file needs the TITLE block, the analysis cards, and at least one command to produce output.

Refer to the GNAP manual for details about individual commands and formats. All data is in weight percent including trace element data. The REFORM options convert the trace element data from ppm in the card file to percent in the analysis cards. The position of the decimal points in the analysis cards is implied: no decimal points appear. The formats for TOMGNAP are user-defined and specified by the MODIFY FORMAT and OXIDES commands in the command files. In this case, since decimal points are implied, F4.2, for example, corresponds to 2 places on each side of the (implied) decimal point.

DUMMY VALUES AND SCALING OF PLOTS

One other element in the command files are the dummy values (see pages 32 to 34 in the GNAP manual). They are used to set the scales of the X-Y axes. Without them the end of each axis is the highest data value, and the beginning is the lowest data value: seldom convenient. You may wish to change the dummies for each data set. You need two dummies, one minimum, one maximum. They follow the exact format of the data except that they start with STO in columns 1 through 3, have DUMM1 or DUMM2 as the identifier in the end columns, and have no plot sumbol in column 4. It is recommended that you generate your analysis cards with REFORM, merge them with a boilerplate command file which is appropriate to their format, check for max and min values in your data, then change the dummies to the desired value to give you an adequate scale.

For X-Y plots on the line printer, GNAP and TOMGNAP divide the abscissa into 10 equal intervals and the ordinate into 5. You may have to experiment to get your scales perfect. And remember that if you will be comparing several data sets, to make the dummies larger and smaller than the largest and smallest values in the entire group. TOMGNAP acts up at very low dummy values; it sometimes doesn't differentiate between a dummy of zero and a value of 1ppm. The 1ppm is plotted correctly but becomes the lowest ordinate value instead of zero. Use .001 or .0001 (whatever fits) instead of dummies of 0 with TOMGNAP. That seems to work. Another problem at low ppm values is that the axis labels are only three-place precision. You will have to write in the last one or two digits. The plots are precise however.

GNAP and TOMGNAP also let you make plots on a large pen-plotter that are nicer than the line printer plots. First run GNAP (or TOMGNAP) and make line printer plots so you know your graphs are right. Then add the following commands to the command file:

```
DEVICE=CALCOMP;
SCALE=n;
```

where n is between 0 and 3. Pen plots are scaled differently from printer plots. The SCALE command determines the size of the plot. The x-axis is divided into 10 divisions but the Y-axis in divided into 7, so the dummy values will have to be changed as well. The way dummies work with pen plots is a little different than with printer plots, and may require experimentation to get the scales just right. See pages 32 through 34 of the GNAP manual.

EXAMPLE OF TOMGNAP COMMAND FILE

```
this is an input command file for tomgnap.  it is formatted for
the output of reform tomgnap option 1 or 2 (analysis 1 or 2 major and
trace element chemistry). delete all lower case instruction lines
before running with tomgnap.

TITLE put your title here

MODIFY FORMAT= (4X,12F4.2,3X,F4.2,21X,4X,15F4.4,16X),NCS=2;
OXIDES SIO2,AL2O3,FE2O3,FEO,MGO,CAO,NA2O,K2O,H2O,TIO2,P2O5,MNO,CO2,
Y,SR,ZR,U,RB,THOR,PB,GA,ZN,CU,NI,CR,V,BA,NB;
PPS;

     put analysis cards here

FEOT=FEO+0.8998*FE2O3;
REST=(C+AB+AN+WO+EN+MT+HM+IL+TN+RU+AP+MG+DI+HY);
K2OIDX=(K2O/(SIO2-45))*1000;
MLDI=0.333*SIO2+K2O-MGO-CAO;
RBSR=RB/SR;
K=K2O*0.8301;
MG=MGO*0.603;
BARB=BA/RB;
SRBA=SR/BA;
KBA=K/BA;
KRB=K/RB;
TIFE=TIO2/FEOT;
TICA=TIO2/CAO;
PLAG=AN+AB;
SUMMARY (OXIDES,ADJUSTED,MINERALS,PARTITIONS,BARTH,NIGGLI,D.I.,RATIOS,USER);
STO 46001000.001.001.001.00102500100.001.001.001.001   .001              DUMM1
STO    1   1   1   1   1   1   1   1   1   1   1   1   1   1   1         DUMM1
STO 760020001000100012501250075006OO 250 500  50 250    100             DUMM2
STO   5020001000  10 200 200  50  50 200 200 5001000 5009999  50         DUMM2
PRINT SIO2,TIO2,AL2O3,FE2O3,FEO,MNO,MGO,CAO,NA2O,K2O,P2O5,Y,SR,ZR,U,RB,THOR,
      PB,GA,ZN,CU,NI,CR,V,BA,NB;
PLOT HARKER;
TERNARY Q,AB,OR;
TERNARY FEOT+MNO,NA2O+K2O,MGO;
TERNARY Q,PLAG,OR;
TERNARY K2O,CAO,NA2O;
TERNARY AB,AN,OR;
TERNARY SIO2,CAO,(NA2O+K2O);
TERNARY Q,OR,REST;
PLOT SIO2,FEOT/(FEOT+MGO);
PLOT SIO2,(NA2O+K2O);
PLOT SIO2,(NA2O+K2O)/CAO;
PLOT SIO2,(NA2O+K2O-CAO+10);
PLOT AN/(AB+AN),AL2O3;
PLOT K2O,NA2O;
PLOT CAO,NA2O+K2O;
PLOT CAO,MGO;
PLOT AL2O3,MGO;
PLOT TIO2,FEOT;
```

```
PLOT TIO2,CAO;
PLOT SIO2,FE2O3/FEO;
PLOT FE2O3+FEO,FE2O3/FEO;
PLOT AN/(AB+AN),AL2O3;
PLOT SIO2,AN/(AB+AN);
PLOT SIO2,Y;
PLOT SIO2,SR;
PLOT SIO2,ZR;
PLOT SIO2,U;
PLOT SIO2,RB;
PLOT SIO2,THOR;
PLOT SIO2,PB;
PLOT SIO2,GA;
PLOT SIO2,BA;
PLOT SIO2,NB;
PLOT SR,RB;
PLOT BA,RB;
PLOT SR,BA;
PLOT K,BA;
PLOT K,RB;
PLOT BA,SR;
PLOT TIO2,Y;
PLOT MGO,Y;
PLOT MLDI,SR;
PLOT K2O,RB;
PLOT SIO2,RBSR;
PLOT SIO2,K/RB;
PLOT SIO2,BA/RB;
PLOT SIO2,THOR/U;
CLEAR STORAGE;

TITLE also put your title here

MODIFY FORMAT= (4X,12F4.2,3X,F4.2,21X,4X,15F4.4,16X),NCS=2;
OXIDES SIO2,AL2O3,FE2O3,FEO,MGO,CAO,NA2O,K2O,H2O,TIO2,P2O5,MNO,CO2,
Y,SR,ZR,U,RB,THOR,PB,GA,ZN,CU,NI,CR,V,BA,NB;

    also put analysis cards here (for modal plots)

STO 4000                                                    DUMM3
STO                                                         DUMM3
STO 9000                                                    DUMM4
STO                                                         DUMM4
CONVERT VALUES;
FEOT=FEO+2*FE2O3;
SIO2WT=60.09*SIO2;
PRINT FEOT;
TERNARY AL2O3,NA2O+K2O,CAO;
TERNARY (AL2O3-NA2O-K2O),CAO,(FEOT+MGO);
PERAL=AL2O3/(NA2O+K2O+CAO);
PRINT PERAL;
APCOR=CAO-(3.33*P2O5);
PERAL2=AL2O3/(NA2O+K2O+APCOR);
PRINT PERAL2;
PLOT SIO2WT,PERAL2;
```

USING TOMGNAP TO PLOT NON-CHEMICAL DATA

You can use TOMGNAP's plotting and listing capabilities on almost any numeric data by entering the data as oxides and then assigning new names to the oxides. You may create a table with REFORM option C of the data you want plotted, and then specify the format in the TOMGNAP command file. For example, a ternary diagram of mode data would be created in the following manner:

Run option C, specifying numeric fields 18,19, and 20 (the percent of quartz, plagioclase, and alkali feldspar), and an unexpanded sample number.

With a text editor or MINITAB, put NRM in the first 3 columns of the table. Put a plotting symbol in column 4. Move the mode data so it starts in column 5, and put it in the following form: remove the decimal points, and round or pad the data so each occupies 4 colums. That is, 65.3 would become 6530. Move the sample number to the last 8 columns of the 80 column line, truncating if necessary. Such column operations are easiest with MINITAB but may be done with an editor as well.

With an editor add the appropriate commands to the table file. For qtz, alk, and plag values of 32.7%, 57.3%, and 20.0%, for the first sample, the final file should look like this (my comments are in lower case):

```
                                                        column 80
TITLE MODES                                                  :
NRMA327057302000                                      H79TM-23
NRMB201042003870                                      H80OW123

            (and the rest of the data cards)
                          .
                          .
                          .
QTZ=SIO2;
PLAG=AL2O3;
ALK=FE2O3;
TERNARY QTZ,ALK,PLAG;
```

Then run TOMGNAP. A printer file will be produced.