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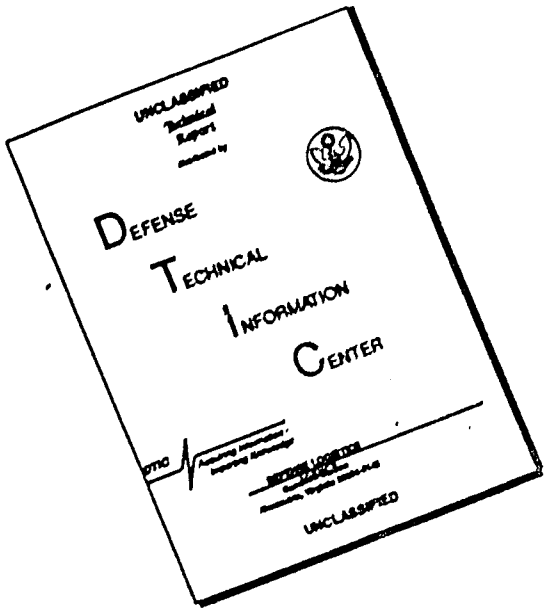

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Technical Report No. 87

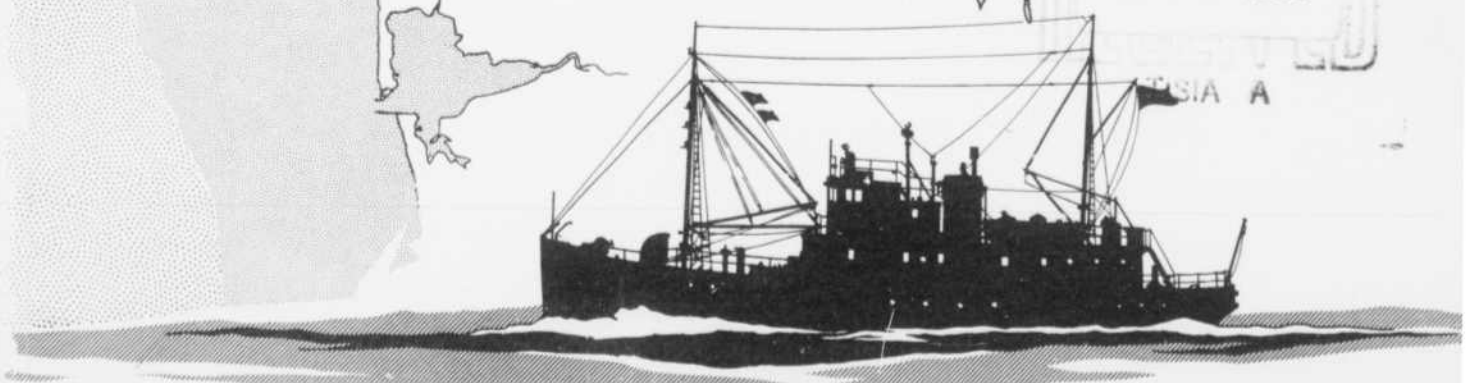
MACHINE PROCESSING OF GEOLOGICAL DATA

by

E. E. Collias, M. R. Rona,
D. A. McManus, and J. S. Creager

Office of Naval Research
Contract Nonr-477(10)
Project NR 083 012

Reference M63-35
August 1963



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Chairman

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ABSTRACT

Detailed instructions are given for using electronic computers to determine the statistics from sediment grain size analyses. The computer programs described are written specifically for the IBM 650 and IBM 709 computers, but they may be adapted for use on other computers.

Two types of programs are described. One gives order statistics such as Trask, Inman, and Folk and Ward values and is referred to as the "sediment description program", whereas the second program gives the moment measures of the grain size distribution.

Copies of the program decks in either symbolic or condensed form are available for a nominal charge.

MACHINE PROCESSING OF GEOLOGICAL DATA

E. E. Collias, M. R. Rona, D. A. McManus and J. S. Creager

1. INTRODUCTION

In recent years, machine processing of geological data of various types has become a standard tool for the geologist. This advancement is due to a recognition of the speed, accuracy and efficiency of modern electronic computers. Although geological data have been processed by electronic computers for some time, e.g., as an aid in mapping facies relationships of sedimentary rocks (Krumbein and Sloss, 1958) or in better describing associations of fossils (Imbrie, 1958), it is only recently that electronic computers have been used to perform more extensive computations on geological data. The diversity of these applications was displayed at the Research Committee Symposium "Geology Enters the Computer Age" which was held during the 47th Annual Meeting of the American Association of Petroleum Geologists in 1962 (see Bull. Am. Assoc. Petroleum Geologists, 1962, v. 46, pp. 256-284 for abstracts). The programs described in this report are examples of computer flexibility in obtaining descriptive statistics on sediment particle size distribution.

Several methods have been used to obtain a statistical description of particle size distribution of sediments. These methods can be classified into two categories: 1) those producing order statistics and 2) those producing moment measures. The order statistics include the graphic measures (percentile estimates) of Trask (Krumbein and Pettijohn, 1938), Inman (1952), and Folk and Ward (1957). The moment measures are classified as first moment about the origin, the mean; second moment about the mean, the standard deviation; the third moment about the mean, the skewness; and the fourth moment about the mean, the kurtosis. In addition to using the graphic approximations and correlative moment measures as methods of describing sediment particle sizes, use is often made of the relationship between the amount of sediment in various size grades, such as the sand to mud ratio.

Because calculations of these quantities could be performed faster and with greater reliability by an electronic computer than by hand, the programs described in this report were prepared for the IBM 650 and IBM 709 data processing systems. The program to compute the order statistics (known as the Sediment Description Program) was written originally for the IBM 650 magnetic drum processing machine, but later, when the IBM 709 data processing system became available, the program was rewritten and enlarged for use with this computer. A second program utilizing the 709 was prepared to compute the moment measures (Moment Measure Program). The 650 program can be adapted for any similar type of computer that has a minimum of a 2,000 ten-digit word memory and the 709 programs can be easily modified to run on any 8,000 bit computer such as the IBM 1401, 1620, CDC or similar computers.

In addition to the computers mentioned, the following IBM peripheral machines are used to prepare the data and tabulate the results: Manual keypunch, Model 10; automatic keypunch, Model 24 or 26; alphabetic

interpreter, Model 557; document originating machine, Model 519 (commonly known as a reproducing punch); sorter, Model 087; and an accounting machine, Model 407 (commonly known as a tabulator).

This report describes in detail the preparation of data for the computers, the operation of the 650 computer and the general procedure for use of the 709 computer, the tabulation of the results, the special features of the sediment description and moments measure programs. Any differences in programs for the two computers (650 and 709) are explained in the pertinent sections of this report.

2. DATA PROCESSING

2.1 Basic preparation of input data

2.1.1 Geological laboratory manipulation. The data supplied to the computers (hereafter called input data) are based upon the amount of the sample contained in the various size classes of a sediment sample. The amount of sample in a given size class is determined by accepted sieve and/or pipette analyses used in routine geological laboratory procedure (Krumbein and Pettijohn, 1938). For best results, it is desirable that the interval between size classes be kept as small as possible, preferably not exceeding one phi-unit[1]. More accurate results may be obtained by using $\frac{1}{4}$-phi-unit intervals. The smallest size class usually reported is 11 ϕ.

The amount of sample within each size class is expressed as either: 1) a percentage of the total sample called the "fraction percentage", or 2) a weight in grams (to the nearest milligram) called the "fraction weight". To save time and to prevent errors in hand computations and transcription of the data, the latter value is preferred in preparing the data for the computer. When fraction weights are used, the "post analytical weight" must be specified. This weight is the total of all fraction weights in a given sample and is equal to the original sample weight, less any loss of sample during the laboratory manipulation of the sample. The maximum acceptable sample weight is 9,999 grams. However, the usual sample weight is less than 100 grams.

---

1 The common method of expressing sediment sizes is with the phi notation of Krumbein (1934). Phi (ϕ) has been re-defined by McManus (in press) as:

$$\phi = - \log_2 \frac{\xi \text{ mm}}{\xi_o \text{ mm}} \qquad (2.1)$$

where ξ is the particle diameter in millimeters and ξ_o is a standard diameter of 1 millimeter. The programs described in this report use phi-notation. If the particle sizes are expressed in millimeters, they should either be converted to phi-notation before submission to the computer or the programs modified to make these conversions prior to computations.

2.1.2 Preparation of summary sheets. Following laboratory analysis of the sample, the resulting data are transcribed on the summary sheet form illustrated in Figure 1. The use of this form facilitates keypunching of the data on Hollerith (IBM) cards. In preparing the summary sheet, two extra size classes are added to the laboratory data as follows: 1) an initial size class coarser than the largest size actually observed is added and indicated as containing zero fraction weight or zero fraction percentage of the sample; 2) a final size class is added to include all material finer than the smallest size class measured in the laboratory. All data fields[2] are to be filled. If no information is available for a field, zeros are inserted. Any field to be duplicated for the entire sample is indicated by a long vertical arrow in that column (see Figure 1).

2.2 Card Formats

2.2.1 Master Cards. One master card is prepared for each sample according to the format listed in Table 1. The master card includes all necessary identification, date of sample collection, geographic location from which the sample was obtained, etc. The card type[3] is indicated by the number zero punched in column 30 an "x-punch"[4] in card column 80. The data for the master card are taken from the upper right hand portion of the summary sheet.

The first twelve card columns are a set of numbers or letters to uniquely identify the sample. It is important that these columns be different for each sample as this identification is used on all cards (input, output and headers) pertaining to that sample. The EXTRA ID field is always a numeric[5] field, whereas the first ten card columns may be alphameric[5], and is used to identify subsamples. Because the sediment description program was developed for the study of recent marine sediments, some of the identification methods will differ from those used by geologists studying paleosediments. Thus, CRUISE NUMBER may be changed to WELL NUMBER, and LATITUDE-LONGITUDE may be replaced by TOWNSHIP-RANGE coordinates.

2.2.2 Detail Cards. One detail card is prepared for each size class contained in the sediment sample and is identified by the number "1" punched in column 30. Data for this type of card is taken from the body of the summary sheet and is punched according to the format presented in Table 2. The information punched on the detail cards

---

2 A field is a group of related card columns; i.e., the FRACTION WEIGHT field includes card columns 46 through 50.

3 There are a total of nine card formats used for input or output by the programs described in this report. Hence it is necessary to identify each type by a number punched in card column 30.

4 By "X-punch" it is understood that this is an overpunch in the 11-zone.

5 An ALPHAMERIC character is any legal Hollerith character such as numbers, letters, special characters or blanks. A NUMERIC field contains only numbers with a sign punched in a specified column of that field.

UW-DO-G 11 (REVISED)

UNIVERSITY OF WASHINGTON – DEPARTMENT OF OCEANOGRAPHY – GEOLOGY SUMMARY SHEET

Vessel	Cruise	Station No.
Brown Bear	BB 236	010

Date of Analysis	Analyst
Jan 14, 1960	Riley

MASTER CARD

Cruise	Sample Number	Sample Type	Extra ID No.	Date Sample Obtained Month	Day	Year	Latitude	Longitude	OCT
BB236	010	56	02	08	03	59	67°21.0'	66447.0'	1
1–5	6–8	9–10	11–12	13–14	15–16	17–18	19–23	24–28	29

CARD TYPE	21 Depth	Not used	Past Analytical Weight		
0	00310	← →	16.801	00	
30	31–35	36–50	51–55	56	

PA IN EXCESS OF 100 GRAMS	Core length	Remarks	CONTROL
000	0175 0		–
58–60	61–65	66–79	80

DETAIL CARD — Duplicate Column No. 1-29, 51-55, 59, 65, from Master Card
Columns 30 always 1. Column 58 always 0.

Depth of sample in core (31–35)	Phi size (36–39)	Sign (40)	Fractional Percent (41–45)	Fractional Weight (46–50)	FRACTIONAL WEIGHT OVER 100 GRAMS (56–57)	Remarks
00310	02.00	–	00.00	00.000	00	
	01.00	–		00.027		
	00.00			00.005		
	01.00			00.012		
	02.00			00.028		
	03.00			00.151		
	04.00			01.836		
	05.00			08.142		
	06.00			02.650		
	07.00			01.450		
	08.00			08.000		
	09.00			00.500		
	10.00			00.450		
	11.00			00.200		
	12.00			00.550		
	.		.	.		
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Fig. 1 Geology Data Summary Sheet

TABLE 1

FORMAT OF GEOLOGY MASTER CARD

Field Number	Card Columns	Field Width	Information	Decimal Placement	Remarks
1	1-5	5	Cruise Number	XXXXX	Alphameric
2	6-8	3	Station Number	XXX	Alphameric
3	9-10	2	Sampler Type	XX	Alphameric, GR = gravity core; VV = Van Veen grab; PC = piston core, etc.
4	11-12	2	Extra Identification	XX	Numeric only, used to state more than one aliquot or sub-sample from the same core or grab sample
5	13-18	6	Date in order as Month/Day/Year	XXXXXX	
6	19-23	5	Latitude to the nearest 0.1 minute	XX° XX.X'	No compass direction, and no punctuation
7	24-28	5	Longitude to the nearest 0.1 minute with hundreds omitted	XX° XX.X'	No compass direction, and no punctuation
8	29	1	Octant in which geographic position occurs	X	See Figure 2 to determine the correct number.
9	30	1	Card Type	X	This is a zero for Master Cards.
10	31-35	5	Depth of sample from a core in millimeters from top of core	XXXXX	If the sample is from a grab, fill in with zeros.
11	36-50	15	Blank or used for other information		
12	51-55	5	Post analytical weight in grams less 100 grams	XX.XXX	To the nearest milligram. If greater than 100 grams, see Field No. 14.
13	56-58	3	Not used	000	FILL IN WITH ZEROS!
14	59-60	2	Post-analytical weight in excess of 100 grams	XX	Maximum sample size = 9999 grams; if not used punch 00
15	61-65	5	Core length in millimeters	XXXXX	Leave blank for grab sample
16	80	1	Control punch	"X"	Must be an "eleven" over-punch!

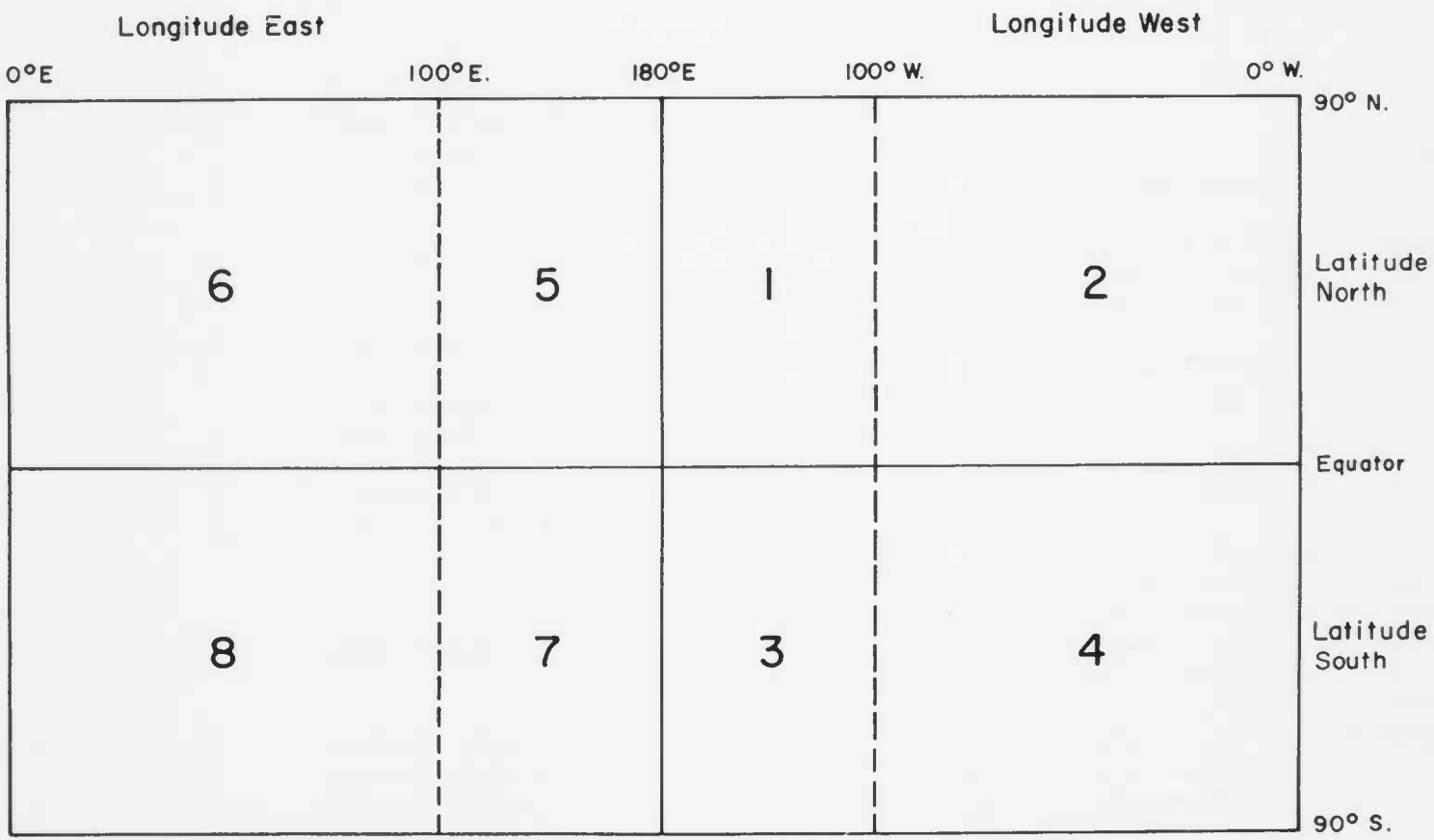

Fig. 2 Coding for Octant of Geographic Position

TABLE 2

FORMAT OF GEOLOGY DETAIL CARD

Note: Fields 1-8 and card columns 1-29 are the same as on the Master Card.

Field Number	Card Columns	Field Width	Information	Decimal Placement	Remarks
9	30	1	Card Type	X	This is the number one (1) for detail cards.
10	31-35	5	Depth of sample	XXXXX	Duplicate from Master Card.
11	36-39	4	The size class in phi-units	XX.XX	To the nearest 0.01 phi-unit.
12	40	1	Sign of phi	X	Must also contain a zero in this column. Use an "eleven" over punch for minus (-) values.
13	41-45	5	Fraction-percentage of sample in this size class	XXX.XX	If not used, fill in with zeros.
14	46-50	5	Fraction-weight of sample in grams-100 grams contained in this size class	XX.XXX	If the weight is greater than 100 grams, list excess in Field 16.
15	51-55	5	Post analytical weight - 100 grams	XX.XXX	Duplicate from Master Card.
16	56-57	2	Fraction weight in excess of 100 grams	XX	Maximum sample size is under 10,000 grams. If not used, punch 00.
17	58	1	Not used	0	Must contain a zero.
18	59-60	2	Post-analytical weight in excess of 100 grams	XX	Duplicate from Master Card.
19	61-65	5	Core length in millimeters	XXXXX	Duplicate from Master Card.
20	80	1	Control punch	X	Blank except for last size class of each sample, which must be the number eight (8).

includes the necessary identification (the same as card columns 1-29 on the master card), size class, fraction weight or fraction percentage, post analytical weight, and any other pertinent information in columns 61-79 of the master card. The last detail card of each sample must have the number "8" punched in column 80 to indicate the end of that particular sample.

The detail cards are used for all further computations and therefore must be complete and accurate before submission to the computer.

2.2.3 Output Cards. Six formats of output cards are produced by the 650 sediment description program, one for each type of computation (see section 3). Table 3 explains the format of the various output cards.

2.2.4 Header cards. Before tabulation of the output cards from the 650 computer, 15 header cards are inserted at selected intervals to properly identify the information being printed. Card columns 1 through 12 are the same as those on the master and detail cards for a given sample. Any alphameric information may be punched in columns 13 through 75 and be printed by the tabulator.

Column 76 is numbered 1 to 7 and indicates the type of output card the header card precedes. Columns 77 - 78 contain numbers to identify various header cards. In addition, column 78 may contain an "X-punch" if a double space is to follow that card. Column 79 may contain an "X-punch" if a page skip is desired before printing the card. Column 80 will always contain the number 9 as this activates the transfer print feature of the 407 tabulator. Table 4 presents the format of the header cards currently in use. Preparation of these cards and the assembly of the final print deck[6] is discussed in section 2.6.

2.3 Input deck[7] preparation

2.3.1 Keypunching data. The keypunching of the data as tabulated on the summary sheets (see section 2.1.2) may be done with either a Model 10 manual keypunch or with one of the automatic keypunches, Models 24 or 26. The Model 26 keypunch is the most desirable because it also prints, along the top edge of the card, the information being punched.

If the Model 10 punch is used, only sufficient identification is punched on the detail cards to properly identify them; this usually consists of part of Field 1 and all of Fields 2, 4 and 9, (see Table 2). Then the size class (Fields 11 and 12), and either fraction percentage (Field 13) or fraction weight (Fields 14 and 16) are punched. Finally, the master cards are prepared.

---

6 A print deck is a group of cards assembled in a specified order for final tabulation.

7 An input deck is a group of cards, in a given sequence, supplied to the computer that contains the necessary data from which computations are made.

TABLE 3

FORMAT OF OUTPUT CARDS

NOTE: All output cards have the same format in Fields 1-8 and 10 (card columns 1-29 and 31-35) as the Master Card. The Card Type (Field 9 card column 30) changes with the various output data. Minus (-) signs are punched over units in Fields 13-20. The characters in parenthese indicate decimal point location, and a preceding zero indicates that this position is always zero. Letters refer to explanatory notes at the end of the table.

Field Number	Card Column	Individual-Size Classes	Phi-Sizes at Percentiles	Sand-Silt-Clay Relationships	Trask Values	Inman Values	Folk and Ward Values
9	30	2	3	4	5	6	7
11	36-39	Size class in phi-units (XX.XX)	zeros	zeros -see A-	zeros	zeros	zeros
12	40	Sign of phi and a zero	Extrapolation Code -see B-	zero	zero	zero	zero
13	41-45	Fraction percentage (0XX.XX)	Phi at 5% (0XX.XX)	Larger-than-sand (0XX.XX)	First Quartile (XX.XXX)	Median Diameter (0XX.XX)	Mean Diameter (0XX.XX)
14	46-50	Accumulated percentage (XXX.XX)	Phi at 16% (0XX.XX)	Sand (0XX.XX)	Second Quartile (XX.XXX)	Mean Diameter (0XX.XX)	zeros -see C-
15	51-55	zeros	Phi at 25% (0XX.XX)	Silt (0XX.XX)	Third Quartile (XX.XXX)	Deviation (0XX.XX)	Deviation (0XX.XX)
16	56-60	t-value (0X.XXX)	Phi at 50% (0XX.XX)	Clay (0XX.XX)	Quartile Deviation (XX.XXX)	Skewness (0XX.XX)	Deviation Code (0000X)

TABLE 3 (continued)

Field Number	Card Column	Individual-Size Classes	Phi-Sizes at Percentiles	Sand-Silt-Clay Relationships	Trask Values	Inman Values	Folk and Ward Values
17	61-65	zeros	Phi at 75% (OXX.XX)	Sum of fraction percentage (XXX.XX)	Log_{10} So (XX.XXX)	Second Skewness (OXX.XX)	Skewness (OXX.XX)
18	66-70	zeros	Phi at 84% (OXX.XX)	Sand-to-Mud Ratio (OXX.XX)	Skewness (XX.XXX)	Kurtosis (OXX.XX)	Skewness Code (0000X)
19	71-75	zeros	Phi at 95% (OXX.XX)	Shepard's Triangle code (00X0A) -see D-	zeros	zeros	Kurtosis (OXX.XX)
20	76-80	zeros	Method used to obtain percentiles (A B C D E) -see E-	zeros	zeros	zeros	Kurtosis Code (0000X)

EXPLANATORY NOTES

A--Zeros mean that this field is not used but does have zeros punched in it.

B--If one of the percentile levels is extrapolated as stated in Table III, it will be coded as a minus number, so
-1 indicates that the 75% level was extrapolated. The 84% and 95% levels will contain 099.99.
-2 indicates that the 84% level was extrapolated. The 95% level will contain 099.99.
-3 indicates that the 95% level was extrapolated.

C--The IBM program prior to January, 1963 used this to indicate a first deviation suggested by Folk and Ward.

TABLE 3 (continued)

D--If X is a "1", the sample falls exactly upon a line in the Shepard triangle. "A" is the code from 1-10.

E--A "0" in positions A, B, or C indicates that the fraction percentage at 5, 16 or 25 was exactly equal to the values and the corresponding phi-size was listed without interpolation.

A "1" in positions A, B, or C indicates that the Aitkens method was used to obtain the phi-sizes at percentiles of 5, 16, and 25.

A "2" in positions A, B, or C indicates that the linear method was used to obtain the phi-sizes at percentiles of 5, 16, and 25.

Positions D and E are the combined methods for the 50 and 75% levels and the 84 and 95% levels, respectively. The number is the sum as follows:

50 and 84% levels		75 and 95% levels	
Exact value	= 0	Exact value	= 0
Aitkens method	= 1	Aitkens method	= 1
Linear method	= 2	Linear method	= 4

Thus, a "2" in D or E indicates that the Aitkens method was used to compute both levels. A "6" indicates that the linear method was used to compute both levels, and so on.

TABLE 4

FORMAT OF HEADER CARDS

CARD COLUMN

```
0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
```

```
                CRUISE                  STATION                     EXID                10J-9
SAMPLER TYPE      DATE   /  /    LAT.    -   . N   LONG.    -   . W102 9
DEPTH FROM TOP OF CORE          MM  LENGTH OF CORE          MM      10L 9
                          PHI    FRACTION ACCUMULATED                204 9
                          SIZE    PERCENT    PERCENT                  20N 9
PHI SIZES AT PERCENT LEVELS OF                                       306 9
   5         16         25         50         75         84         95  30P 9
SAND. SILT. CLAY RELATIONSHIPS                                       408 9
GRAVEL      SAND       SILT       CLAY      TOTAL   SAND/MUD    CLASS  40R 9
TRASK VALUES                                                         510 9
   Q1         Q2         Q3         SO      LOG SO      SKG           51J 9
INMAN VALUES                                                         612 9
 MEDIAN     MEAN       DEV.       SKEW.   2ND SKEW.  KURT.           61L 9
FOLK AND WARD VALUES                                                 714 9
  MEAN                 DEV.    TYPE       SKEW.  TYPE       KURT.  TYPE71N 9
```

```
0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
```

If an automatic keypunch is used, the master cards are prepared first and then the information contained in Fields 1 - 10, 15, 17, 18 and 19 is automatically duplicated on the detail cards for each sample.

2.3.2 Gangpunching detail cards. If in preparing detail cards the information to be duplicated from the master to detail cards was not done with an automatic keypunch, it will be necessary to use a reproducing punch to supply the missing information. Before using this machine, the proper master card must precede the detail card for each sample. This is done by hand or by using a sorter as follows: 1) Place the master cards followed by the detail cards in the read feed. 2) Sort on card columns 12, 11, 8, 7 and 6. If more than one cruise is included in the set of input data, sort on columns 5, 4, 3, 2 and 1. This prescribed order is important but any column known to contain the same information may be omitted from the sort. The resulting deck will contain a series of master cards followed by the matching detail cards.

The 519 reproducing punch is used as follows: 1) Insert a control panel wired according to Table 5; 2) set the X-SENSE brushes of both the read and punch feeds on card column 80 and connect to position 1; 3) place the cards in the punch unit; and 4) start the punch feed. After a stack of about three inches has been punched, 5) stop the machine; 6) place the punched cards in the read feed; 7) restart the machine and 8) continue adding cards to the punch feed and then to the read feed until finished. These last steps check the gang punching for machine errors.

2.3.3 Interpreting the cards. If a printing keypunch is not used, it is necessary to interpret portions of data on the cards using an alphabetic interpreter. A control panel for use with the model 557 alphabetic interpreter is described in Table 6. The ENTRY switch is set to position ONE for interpreting the detail cards.

2.3.4 Removal of master cards. Before proofreading the detail cards and/or preparing the input deck for the computer, it is necessary to remove the master cards by sorting on column 30. The master cards fall in the "zero" bin and the detail in the "one" bin.

2.3.5 Tabulation of input data for proofreading. The master cards are proofread from a tabulation made on the 407 using a "standard 80-80 board" that prints all the information as it appears on the cards. Most computer facilities have such a control panel prewired for the 407 tabulator.

The detail cards are proofread from a tabulation using the 407 with the control panel wired according to the description in Appendix 2. Place a blank card with the number "8" punched in column 80 in front of the deck to be tabulated in order to clear selected counters of the tabulator. Set the TRANSFER and FUNCTION switches to: TTNN TTTT. The proofsheet (shown in figure 3) is then checked against the original summary sheets and any errors are corrected. The blank card with an "8" in column 80 is removed immediately after tabulation.

					0.000**
BB236	10	2	0310	- 2.00	0.000
BB236	10	2	0310	- 1.00	0.027
BB236	10	2	0310	0.00	0.005
BB236	10	2	0310	1.00	0.012
BB236	10	2	0310	2.00	0.028
BB236	10	2	0310	3.00	0.151
BB236	10	2	0310	4.00	1.836
BB236	10	2	0310	5.00	8.142
BB236	10	2	0310	6.00	2.650
BB236	10	2	0310	7.00	1.450
BB236	10	2	0310	8.00	0.800
BB236	10	2	0310	9.00	0.500
BB236	10	2	0310	10.00	0.450
BB236	10	2	0310	11.00	0.200
BB236	10	2	0310	12.00	0.550
					16.801*
					16.801**

Fig. 3 Proof Sheet of Example Geology Input Data

TABLE 5

Control Panel Wiring for Gangpunching Detail Cards

(for use with the IBM 519 Reproducer)

1) Read X to Read Pick-Up (H 1 to Q 3)

2) Read Pick-Up to Comp Pick-Up (Q 4 to U 4)

3) Jackplug Read X (N 3 to P 3)

4) Jackplug Comp Pick-Up (S 3 to T 3)

5) Punch X to Punch Direct Pick-Up (H 2 to K 3)

6) Jackplug Punch Direct Pick-Up (H 3 to J 3)

7) Jackplug GANG PUNCHING AND INTERPRETING BRUSHES to PUNCH NORMAL

1 - 5

9 - 10

13 - 29

31 - 35

51 - 55

59 - 65

8) Jackplug REPRODUCING BRUSHES to COMPARING UNIT

Same as # 7

9) Jackplug COMPARING AND TRANSCRIBING BRUSHES to COMPARING UNIT

Same as # 7

TABLE 6

Control Panel Wiring for Interpreting Input and Output Cards
(for the IBM 557 Interpreter)

From Interpret Reading		To Print Entry 1	
1 - 5	(D 1 - 5)	1 - 5	(M 1 - 5)
6 - 8	(D 6 - 8)	7 - 9	(M 7 - 9)
9 - 10	(D 9 - 10)	11 - 12	(M 11 - 12)
11 - 12	(D 11 - 12)	14 - 15	(M 14 - 15)
30	(F 10)	17	(M 17)
31 - 35	(F 11 - 15)	19 - 23	(M 19 - 20; N 1 - 3)
36 - 37	(F 16 - 17)	27 - 28	(N 7 - 8)
38 - 39	(F 18 - 19)	30 - 31	(N 10 - 11)
41 - 43	(H 1 - 3)	33 - 35	(N 13 - 15)
44 - 45	(H 4 - 5)	37 - 38	(N 17 - 18)
46 - 47	(H 6 - 7)	43 - 44	(P 3 - 4)
48 - 50	(H 8 - 10)	46 - 48	(P 6 - 8)
51 - 52	(H 11 - 12)	52 - 53	(P 12 - 13)
53 - 55	(H 13 - 15)	55 - 57	(P 15 - 17)
56 - 57	(H 16 - 17)	41 - 42	(P 1 - 2)
59 - 60	(H 19 - 20)	50 - 51	(P 10 - 11)
40	(F 20)	to Int Col Split 1 - C	(E 21)
Int Col Split 11 - 12	(D 21)	26	(N 6)
Int Emit Period	(W 21)	29	(N 9)
" " "	"	36	(N 16)
" " "	"	45	(P 5)
" " "	"	54	(P 14)
Suppression X jack plugged		(P 21 - Q 21)	
Zero Print Control		jack plugged 1 - 57	

From Proof Reading		To Proof Entry 1	
1 - 5	(D 23 - 27)	1 - 5	(M 1 - 5)
6 - 8	(D 28 - 30)	7 - 9	(M 29 - 31)
9 - 10	(D 31 - 32)	11 - 12	(M 33 - 34)
11 - 12	(D 33 - 34)	14 - 15	(M 36 - 37)
30	(F 32)	17	(M 39)
31 - 32	(F 33 - 34)	19 - 20	(M 41 - 42)
33 - 35	(F 35 - 37)	21 - 23	(N 23 - 25)
36 - 37	(F 38 - 39)	27 - 28	(N 29 - 30)
38 - 39	(F 40 - 41)	30 - 31	(N 32 - 33)
41 - 43	(H 23 - 25)	33 - 35	(N 35 - 37)
44 - 45	(H 26 - 27)	37 - 38	(N 39 - 40)
46 - 47	(H 28 - 29)	43 - 44	(P 25 - 26)
48 - 50	(H 30 - 32)	46 - 48	(P 28 - 30)
51 - 52	(H 33 - 34)	52 - 53	(P 34 - 35)
53 - 55	(H 35 - 37)	55 - 57	(P 37 - 39)
56 - 57	(H 38 - 39)	41 - 42	(P 23 - 24)
59 - 60	(H 41 - 42)	50 - 51	(P 32 - 33)

TABLE 6 (continued)

From Proof Reading	To Proof Entry 1
40 (F 32)	to Proof Col Split 1 - C (H 21)
Proof Col Split 11 - 12 (G 21)	26 (N 28)
Proof Emit Period (W 43)	29 (N 31)
" " " "	36 (N 38)
" " " "	45 (P 27)
" " " "	54 (P 36)

From Interpret Reading	To Print Entry 2
1 - 5 (E 1 - 5)	1 - 5 (Q 1 - 5)
6 - 8 (E 6 - 8)	7 - 9 (Q 7 - 9)
9 - 10 (E 9 - 10)	11 - 12 (Q 11 - 12)
11 - 12 (E 11 - 12)	14 - 15 (Q 14 - 15)
30 (G 30)	17 (Q 17)
31 - 32 (G 31 - 32)	19 - 20 (Q 19 - 20)
33 - 35 (G 33 - 35)	21 - 23 (R 21 - 23)

From Proof Reading	To Proof Entry 2
1 - 5 (E 23 - 27)	1 - 5 (Q 23 - 27)
6 - 8 (E 28 - 30)	7 - 9 (Q 29 - 31)
9 - 10 (E 31 - 32)	11 - 12 (Q 33 - 34)
11 - 12 (E 33 - 34)	14 - 15 (Q 36 - 37)
30 (G 32)	17 (Q 39)
31 - 32 (G 33 - 34)	19 - 20 (Q 41 - 42)
33 - 35 (G 35 - 37)	21 - 23 (R 23 - 25)

2.3.6 Sorting cards before computations. Before the detail cards are submitted to the computer it is necessary to ascertain that the samples and size classes contained in these samples are in the correct order. An examination of the proofsheets will usually indicate whether or not the cards need sorting. If the cards have been dropped or otherwise mishandled, then it is imperative to make a sort.

Because of the presence of negative size classes, it is important to follow closely the following sorting procedure:

First, sort all cards on column 40, using ZONE sort and ZERO SUPPRESSION. The negative size classes will be found in the "11" bin and the positive size classes will fall in the "reject" bin. Keep the two decks separated!

Second, sort the negative size class cards on columns 39, 38, picking up the cards from the stackers in the order zero to nine. If these two columns are known to contain zeros, omit this step.

Third, sort on column 37, but this time pick up the cards from the stackers in the order nine to zero. Temporarily store the cards.

Fourth, sort the positive size class cards on columns 39, 38, 37, 36 in the usual manner and store separately. If columns 39 and 38 contain zeros, omit these sorts.

Fifth, place the negative class cards and sort on columns 12, 11, 10, 9, 8, 7 and 6. If the set of detail cards contains more than one cruise, it will be necessary to sort on columns 5, 4, 3, 2 and 1. Superfluous sorting may be eliminated if some of the columns are known to contain the same punches.

After sorting, the cards will be in order of increasing cruise number, increasing station number, increasing EXTRA ID; and, within each sample, the cards will be in increasing numerical order of size class, beginning with the largest negative class and ending with the largest positive class.

2.4 Procedure for job submission to the computers

2.4.1 650 procedure. If the computer facility to be used has a 650 computer, the chances are that it is a self-service type operation and thus will give the person interested in the final results more control over the computations. This is especially important if any errors in the input deck are detected by the computer. But if the computer facility is a closed-shop operation, it will be necessary to submit detailed instruction to the computer operator. In either case, the cards to be submitted must be in the following order:

1) Program deck number 0212 (309 cards in this program).
2) The detail cards in correct sequence (see section 2.3.6) and
3) An "end" card containing nines punched in all 80 columns.

Also, the computer facility will require the control panel for the 650 as described in Appendix 1.

2.4.2 709 Computer procedure. The following job submitting procedure applies specifically to the 709 computer facility at the University of Washington but is similar to other 709 facilities. The operation of this 709 computer facility is a closed shop operation and requires the deck to be prepared in the following order:

1. Run Request No. card.
2. I.D. card bearing the job number and name of the investigator
3. XEQ card
4. MAX TIME card
5. CARDS COLUMNS (FORTRAN symbolic deck if used)
6. SAVE tape card, if one desires to save the output tape
7. TAPE CARD OFFLINE, if punched cards output desired
8. LABEL
9. FORTRAN program deck 709-0213 (1018 cards)
10. Subroutines BTSNU, EXOR, XRND
11. END card
12. DATA card, followed by the
13. D A T A
14. END data card.

Note: If binary deck is used, omit cards nos. 5, 8, replace the FORTRAN deck (no. 9) by the binary deck of the main program and the binary decks of the subroutines.

2.5 Operation of the 650 computer

2.5.1 Console settings. The settings of the switches on the console of the 650 are as follows:

Storage entry switches	- 7 0 1 9 5 2 2 0 0 0 +
Programmed	- STOP
Half cycle	- RUN
Address selection	- 0 2 0 0
Control	- RUN
Display	- DISTRIBUTOR
Overflow	- STOP
Error	- STOP

2.5.2 Preparation of the read punch unit. Before the computer is started, a control panel, as described in Appendix I, is inserted into the read-punch unit. The drum clear card and program deck are placed in the read feed followed by the detail cards. The desired type of blank cards are placed in the punch feed. It is usually not possible to put in all the cards to be read or punched at one time; therefore, do not overfill either feed but rather add cards as necessary to keep both feeds about two-thirds full.

2.5.3 Starting the computer. The 650 is started by depressing the control buttons in the following order: COMPUTER RESET, PROGRAM START, READ FEED START and PUNCH FEED START. The first card will be read

and the read feed stop for about 6 seconds before the remaining program cards are read. After the program has been read into memory, there will be another pause of about three seconds before the first sample is read. The samples will then be read with about five second pauses between each set unless the machine stops for some type of error.

2.5.4 Programmed stops. There are two programmed stops that might occur if data containing errors are submitted to the computer. Both of these stops will display the same information in the upper and lower accumulator, the distributor, and the program register. Hence, any of the four left hand positions of the DISPLAY switch will indicate the error. These error stops appear on the DISPLAY lights as:

(a) 0 1 1 9 9 9 0 2 0 0 indicating no zero percent card for that sample.
(b) 0 1 1 6 6 6 0 2 0 0 indicating cards not in order of increasing size class.

In either case, the computer may be restarted as follows:

First, remove the cards that have not yet been read from the READ FEED and place them on top of the read-feed unit.

Second, remove the cards already read from the READ FEED and keep them in a separate place.

Third, depress the READ FEED START key until all cards are run out of the READ FEED.

Fourth, isolate the incorrect sample by observing the identifying code as interpreted on the upper-left side of the card. It may be necessary to take cards from both stacks of cards removed from the READ FEED in order to reconstitute the sample.

Fifth, replace the remaining unread cards in the READ FEED and depress the following keys:

(a) READ FEED START
(b) PROGRAM START
(c) PUNCH FEED START

Sixth, while the computer is processing the remaining samples, carefully examine the incorrect sample to (a) locate the zero-percent card, and/or (b) restore the correct sequence of size class. In either case, it will be necessary to correct the detail cards before re-computing.

Thus, it is useful to have a copy of the original summary sheets at the computer in order to make the corrections at the computer facility.

2.5.5 Other error stops. The other sources of error stops are usually due to mispunched detail cards. The most common error is a missing zero-punch in column 40 (see Table 2). When this error occurs,

the lights labeled DISTRIBUTOR and ACCUMULATOR will be "ON". If this happens, set the DISPLAY switch to DISTRIBUTOR and look at the righthand column of the DISPLAY lights; they will be "OFF" and the ADDRESS lights will read 0 0 0 5. Other punching errors will be indicated by either blank positions in the DISPLAY lights or by more than two lights being "ON" in each set of lights. Before restarting the computer, record the information in the DISPLAY lights with the DISPLAY switch in the DISTRIBUTOR position, and the ADDRESS light indication; then remove the incorrect sample as described in section 2.5.4, and restart the computer as follows:

1. set the control switch to MANUAL
2. depress COMPUTER RESET
3. set the control switch to RUN
4. depress PROGRAM START
5. depress READ FEED START
6. depress PUNCH FEED START

Two other conditions will cause the computer to stop and are indicated by the INPUT-OUTPUT light "ON".

If the OPERATION lights read 7 0, the read feed either is full or all the cards except the last three have been read. In the first case remove the used cards from the READ FEED and depress READ FEED START. Otherwise, depress the END OF FILE key. If the OPERATION lights read 7 1, the punch hopper is either full or more blank cards need to be added. If the punch hopper if full, remove the punched cards and depress the PUNCH FEED START. Or in the latter case, add more blank cards and then depress the PUNCH FEED START.

2.6 Output deck manipulation

2.6.1 Interpret output cards. The output cards from the computer are interpreted using the same control panel as used in section 2.3.3 (see Table 6) but the ENTRY switch is set to position TWO.

2.6.2 Header card preparation. The header cards (described in section 2.2.4) are prepared from the master cards as follows:
1) A sufficient quantity of each of the 15 types of header cards are gangpunched in advance using an 80-80 gangpunch panel[8] in the reproducer.
2) Header cards numbered 4 through 15 are prepared individually by reproducing the information from columns 1 through 12 of the master cards into columns 1 through 12 of each of the header cards. This is done by running each of the twelve different header cards separately with the master cards using the control panel as described in Table 7.
3) Header cards 1, 2 and 3 require more complex control panel wiring. For header card number 1, use the wiring as described in Table 8, for header card number 2, use Table 9 and for header card number 3, use

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8 This type of control panel will make an exact copy of the card to be duplicated and is available prewired at most computer facilities.

Table 10. When this step is completed, there will be fifteen header cards for each master card.

2.6.3 Assembly of print deck. The print deck is assembled, using the sorter as follows: 1) Place the header cards in the sorter with header card number 1 first followed by the remaining header cards in numerical order and sort on column 76. 2) Without removing the header cards from the bins, unless the bins are full, place the output deck in the sorter and sort on column 30. 3) Sort the entire deck on columns 12, 11, 10, 9 etc. to 1. Unnecessary sorting may be avoided if the cards are known to contain the same information in any of the columns. The print deck is now ready for tabulation.

2.6.4 Tabulation of the print deck. The print deck is tabulated using the 407 tabulator with the control panel described in Appendix II with all operation switches in the NORMAL position. The final tabulation may be made on single or multiple part paper, on fluid duplicator stencils or on paper masters for offset printing such as the Multilith process. An example of the finished tabulation is shown in Figure 4.

TABLE 7

Control Panel Wiring for Preparation of Header Cards
4 through 15 from Master Cards
(For use with 519 Reproducer)

1) Jackplug GANG PUNCHING AND INTERPRETING BRUSHES to COMPARING UNIT 1 - 12

2) Jackplug REPRODUCING BRUSHES to PUNCH DIRECT REPRODUCING MS & GP 1 - 12

3) Jackplug COMPARING AND TRANSCRIBING BRUSHES to COMPARING UNIT 1 - 12

4) Jackplug Reproducing (1) (A 1 - B 1)

TABLE 8

Control Panel Wiring for Preparation of Header Card No. 1 from Master Cards
(For Use with 519 Reproducer)

1) Jackplug GANGPUNCHING AND INTERPRETING BRUSHES to COMPARING UNIT 1 - 12

2) Jackplug REPRODUCING BRUSHES to PUNCH DIRECT REPRODUCING MS & GP 9 - 10

3) Intercolumn split REPRODUCING BRUSHES to PUNCH DIRECT REPRODUCING MS & GP

1	to	1	and	31
2	to	2	and	32
3	to	3	and	33
4	to	4	and	34
5	to	5	and	35
6	to	6	and	49
7	to	7	and	50
8	to	8	and	51
11	to	11	and	67
12	to	12	and	68

4) Jackplug COMPARING AND TRANSCRIBING BRUSHES to COMPARING UNIT 1 - 12

5) Jackplug Reproducing (1) (A 1 - B 1)

TABLE 9

Control Panel Wiring for Header Card No. 2 from Master Cards
(For Use with 519 Reproducer)

1) Jackplug Reproducing (1) (A 1 - B 1)

2) Jackplug GANG PUNCHING AND INTERPRETING BRUSHES to COMPARING UNIT 1 - 12

3) Jackplug REPRODUCING BRUSHES to PUNCH DIRECT REPRODUCING MS & GP 1 - 8; 11 - 12

4) Intercolumn Split REPRODUCING BRUSHES to PUNCH DIRECT REPRODUCING MS & GP

9 to 9 and 26

10 to 10 and 27

5) REPRODUCING BRUSHES to PUNCH DIRECT REPRODUCING MS & GP

13 - 14 to 35 - 36

15 - 16 to 38 - 39

17 - 18 to 41 - 42

19 - 20 to 50 - 51

21 - 22 to 53 - 54

23 to 55

24 - 25 to 68 - 69

26 - 27 to 71 - 72

28 to 74

TABLE 10

Control Panel Wiring for Header Card No. 3 from Master Cards
(For Use with 519 Reproducer)

1) Jackplug GANG PUNCHING AND INTERPRETING BRUSHES to COMPARING UNIT 1 - 12

2) Jackplug REPRODUCING BRUSHES to PUNCH DIRECT REPRODUCING MS & GP 1 - 12

3) REPRODUCING BRUSHES to PUNCH DIRECT REPRODUCING MS & GP

31 to 36

32 to 37

33 to 38

34 to 39

35 to 40

61 to 60

62 to 61

63 to 62

64 to 63

65 to 64

4) Jackplug COMPARING AND TRANSCRIBING BRUSHES to COMPARING UNIT 1 - 12

5) Jackplug Reproducing (1) (A 1 - B 1)

CRUISE BB 236 STATION 010 EXID 02

SAMPLER TYPE SG DATE 08/03/59 LAT. 67-21.0N LONG. 166-47.0W
DEPTH FROM TOP OF CORE 00310 MM LENGTH OF CORE 01750 MM

PHI SIZE	FRACTION PERCENT	ACCUMULATED PERCENT
-2.00	0.00	0.00
-1.00	0.16	0.16
0.00	0.03	0.19
1.00	0.07	0.26
2.00	0.17	0.43
3.00	0.90	1.33
4.00	10.93	12.26
5.00	48.46	60.72
6.00	15.77	76.49
7.00	8.63	85.12
8.00	4.76	89.88
9.00	2.98	92.86
10.00	2.68	95.54
11.00	1.19	96.73
12.00	3.27	100.00

PHI SIZES AT PERCENT LEVELS OF

5	16	25	50	75	84	95	
3.74	4.06	4.17	4.63	5.87	6.83	9.73	11122

SAND. SILT. CLAY RELATIONSHIPS

GRAVEL	SAND	SILT	CLAY	TOTAL	SAND/MUD	CLASS
0.16	12.09	77.63	10.12	100.00	0.14	4

TRASK VALUES

Q1	Q2	Q3	SO	LOG SO	SKG
0.056	0.041	0.017	1.805	0.257	0.76

INMAN VALUES

MEDIAN	MEAN	DEV.	SKEW.	2ND SKEW.	KURT.
4.63	5.44	1.39	0.59	1.52	1.16

FOLK AND WARD VALUES

MEAN	DEV.	TYPE	SKEW.	TYPE	KURT.	TYPE
5.17	1.60	4	0.65	5	1.44	3

Fig. 4 Example of Output from the Sediment Description Programs

3. SEDIMENT DESCRIPTION PROGRAMS (Nos. 0212 and 0213)[9]

3.1 General description

The Sediment Description Programs provide a variety of data on sediment texture, including percentages of gravel, sand, silt, and clay, the sand/mud ratio, and three end-member textural class designations; the phi-sizes at selected percentile levels, and the percentile measures referred to as Trask values, Inman values, and Folk and Ward values. The main differences between the two programs is that 0212 is written for the IBM 650 computer and produces only card output, whereas 0213 is written for the IBM 709 and produces a written output. The flow chart for these programs is presented in Figure 5.

3.2 Computer program coding

The 650 computer program was coded using SOAP-H[10] and is listed in Appendix 3. The 709 program was coded in FORTRAN II and is listed in Appendix 4.

3.3 Restrictions

Although restrictions have been mentioned in preceding sections, they will be summarized here: 1) The 650 program will accept only 49 size classes within any given sample, whereas the 709 program will accept up to 100 size classes. 2) Any values missing from the input data up to card column 60 must be filled in with zeros. This is particularly true of detail card column 40, the sign of phi, which must contain a zero-punch as well as the sign. 3) The first detail card of each sample must be a "zero percent" card.

3.4 Subroutines

The 650 program utilizes the following subroutines:

1) Exponential, IBM File Number 3.1.004, computes e^X where X has a range from - 16.11 to 23.02585092,

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9 0212 is the code number given to the IBM 650 Sediment Description Program. 0213 is the code number given to the IBM 709 Sediment Description Program.

10 SOAP-H was written by personnel from the University of Washington, Research Computer Laboratory. It includes features such as preparation of a condensed program deck and sequential number of location, neither of which are found in SOAP II.

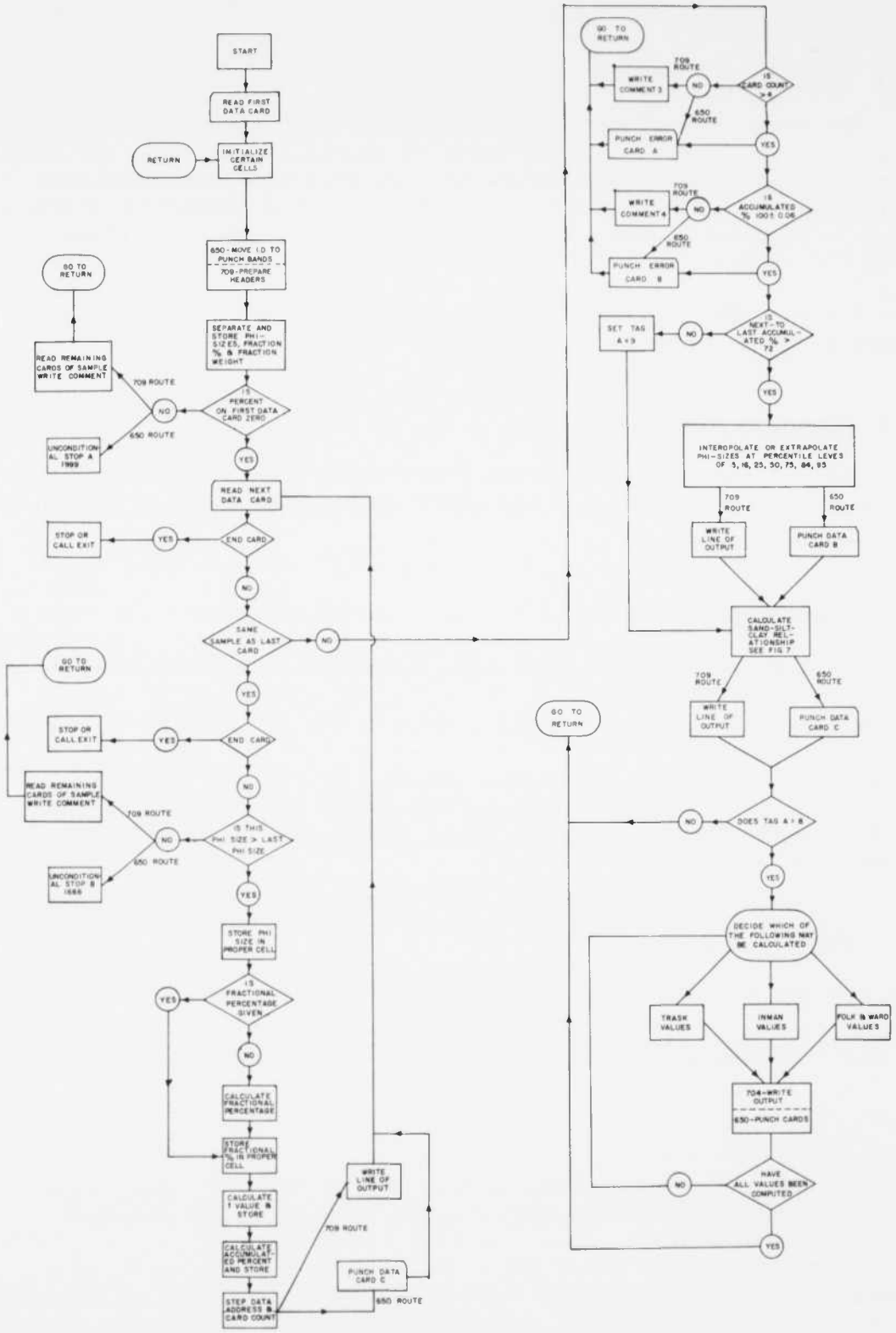

Fig. 5 Flow Chart for Sedimentary Description Programs

2) Log base 10 or base E-fixed point, University of Washington Research Computer number 5002, and

3) Square root - fixed point, IBM Technical Newsletter No. 9, pp. 30-33.

These subroutines have been incorporated into the 650 program and are not required as separate programs. The 709 program utilizes the following subroutines not incorporated in the FORTRAN master tape:

BTSNU (see Appendix 6)
EXOR (see Appendix 7)
XRND (see Appendix 8)

3.5 Conversion of input data

Both the 650 and 709 programs process one sample at a time. The first detail card read by the program causes initialization of selected words in memory. The identification on this card is moved to the punch bands by the 650 program whereas the 709 program prepares the header information. Next, the fraction percentage and fraction weight are checked to ascertain that they are both zero. If not, an error statement is prepared and executed (SOAP-H card no. 111 and FORTRAN statement no. 1990). Such errors stop the 650 computer (see section 2.5.4), but the 709 program will read the remaining cards of this sample and check for other errors as described in the following paragraphs. However, no further computations will be performed and the sample will ultimately be rejected.

Successive detail cards are read until the end of the sample has been reached. As each detail card is read, the size class is checked to insure that the size classes are in order of ascending phi-size. If they are not, the second error statement is prepared and executed (SOAP-H card no. 165 and FORTRAN statement no. 1666). The data on the detail cards are then scanned to determine whether fraction percentage or fraction weight is punched. If the fraction weight is punched, the fraction percentage is calculated from the equation:

$$\text{fraction percentage} = \frac{\text{fraction weight X 100}}{\text{post analytical weight}} \qquad (3.1)$$

Next, the sum of the fraction percentages is accumulated from the first detail card of each sample to and including the size class being processed. From this accumulated percentage, a t-value[11] is determined

11 The t-value is the area under a normal distribution curve expressed in standard deviation units from the center point of 50% of the value of interest. The sign attached to that value is (-) from 0 to 50% and (+) from 50 to 100%. The minimum t-value is -4.090 for 0% and the maximum + 4.090 for 100%: e.g., for an accumulated percentage of 34.83, the t-value is: -0.390.

by TABLE LOOK UP. The computer scans a table of accumulated percentage values and interpolates for the correct t-values. If the accumulated percentage values are closely spaced, the accuracy of the interpolation is better than 0.001 t-units. The t-values are used to determine the phi-sizes at percentile levels of 5, 16, 25, 50, 75, 84 and 95. This is the equivalent of plotting by hand, on normal probability paper, the size-class against accumulated percentage.

After all detail cards for a given sample have been read, the final accumulated percentage must be 100.00 ± 0.06, or the sample is rejected and the third error statement prepared and executed. (SOAP card no. 303 and FORTRAN statement no. 100). If this error occurs, the program bypasses all further computations and selects the next sample to restart the process. If the data pass the above test, the next-to-last size class is then checked to ascertain that the accumulated percentage at this level (called the next-to-last accumulated percentage) is greater than 72. If this is not the case, only the sand-silt-clay relationships are calculated.

3.6 Interpolation of phi sizes at selected percentile levels

The phi-sizes at percentile levels of 5, 16, 25 and 50 are computed from the t-values by two interpolation routines; a) the four-point Aitkens method (Milne, 1948), and b) the two-point linear method. Then, depending upon the value of the next-to-last accumulated percentage the phi-sizes at percentile levels of 75, 84 and 95 are either interpolated or extrapolated as explained in Table 11.

The equations for the four-point Aitkens method of interpolation by successive iterations are as follows:

$$P_{1,2} = \left[(Y_1)(X_2 - X) - (Y_2)(X_1 - X)\right] \div (X_2 - X_1) \quad (3.2)$$

$$P_{1,3} = \left[(Y_1)(X_3 - X) - (Y_3)(X_1 - X)\right] \div (X_3 - X_1) \quad (3.3)$$

$$P_{1,4} = \left[(Y_1)(X_4 - X) - (Y_4)(X_1 - X)\right] \div (X_4 - X_1) \quad (3.4)$$

$$P_{1,2,3} = \left[(P_{1,2})(X_3 - X) - (P_{1,3})(X_2 - X)\right] \div (X_3 - X_2) \quad (3.5)$$

$$P_{1,2,4} = \left[(P_{1,2})(X_4 - X) - (P_{1,4})(X_2 - X)\right] \div (X_4 - X_2) \quad (3.6)$$

$$Y_A = \left[(P_{1,2,3})(X_4 - X) - (P_{1,2,4})(X_3 - X)\right] \div (X_4 - X_3) \quad (3.7)$$

TABLE 11

PERCENTILE LEVELS AND STATISTICAL RESULTS COMPUTED
ACCORDING TO VALUE OF NEXT-TO-LAST ACCUMULATED PERCENT

Value of Next-to-last Accumulated Percent		Highest Percentile Level to be Computed	Method used	Statistical Values Computed				
				Sand-Silt-Clay	Trask	Inman		Folk & Ward
						A	B	
greater than	less than							
---	72	none	---	X				
72	75	75	extrapolation	X	X			
75	81	75	interpolation	X	X			
81	84	84	extrapolation	X	X	X		
84	92	84	interpolation	X	X	X		
92	95	95	extrapolation	X	X	X	X	X
95	100.06	95	interpolation	X	X	X	X	X
100.06	-	sample rejected						

X indicates that this value is computed

where X_1, X_2, X_3 and X_4 are the t-values corresponding to the phi-sizes Y_1, Y_2, Y_3 and Y_4. X is the t-values at the desired percentile level and Y_A is the desired answer.

The second method is a linear two-point interpolation routine of the form

$$Y_L = \left[(X - X_1) \quad (Y_2 - Y_1)\right] \div (X_2 - X_1) + Y_1 \qquad (3.8)$$

where X_1 and X_2 are t-values corrsponding to the phi-sizes Y_1 and Y_2. X is the t-value at the desired percentile level and Y_L is the desired value.

If Y_A and Y_L agree within 0.20 phi-units and if the Aitkens value is between the two adjacent size classes, the Aitkens value is used in preference to the linear result. This process corresponds to drawing a smoothed curve on the normal probability paper rather than a series of straight lines. After the last percentile level has been calculated, a statement of the results is prepared including a code to indicate the method used in obtaining any particular percentile level.

3.7 Sand-silt-clay relationships

After the selected percentile levels have been obtained, the sand-silt-clay relationships are computed as follows:

1. The weight percentage of material that will not pass through the -1 ϕ sieve is listed as gravel.

2. Material that will pass through the -1 ϕ sieve but is retained by the 4 ϕ sieve is listed as sand.

3. Material finer than 4 ϕ, but coarser than 9 ϕ is listed as silt.

4. All material finer than 8 ϕ is listed as clay.

5. The ratio of material coarser than 5 ϕ to that finer than 4 ϕ is computed to give a sand-to-mud ratio, and

6. The position of the sample in the triangular classification of Shepard (1954) is coded according to Figure 6.

The position of the sample on the Shepard triangular diagram was determined from the percentage of sand-gravel, silt and clay present in the sample. The flow chart for this selection is shown in Figure 7. If the sample happens to fall upon a line, this is indicated in the output by the number "one" preceeding the position code.

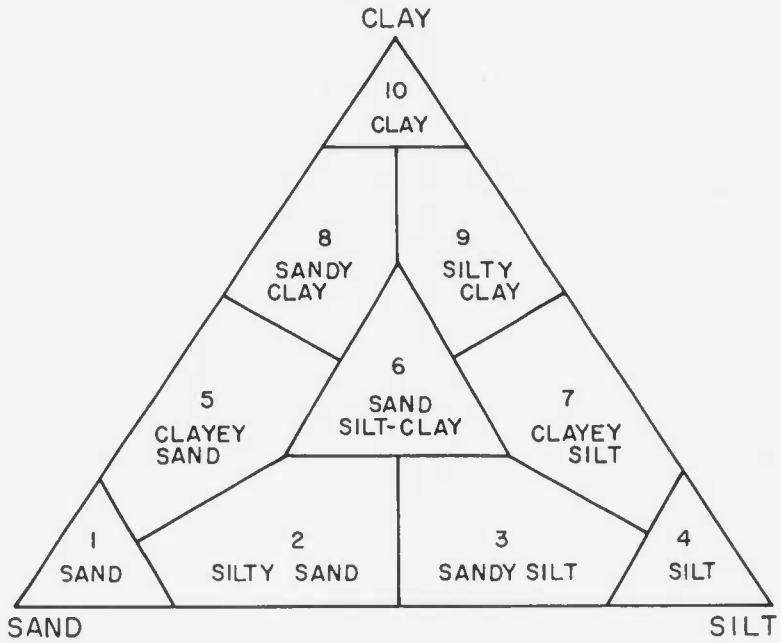

Fig. 6 Triangular Classification According to Shepard

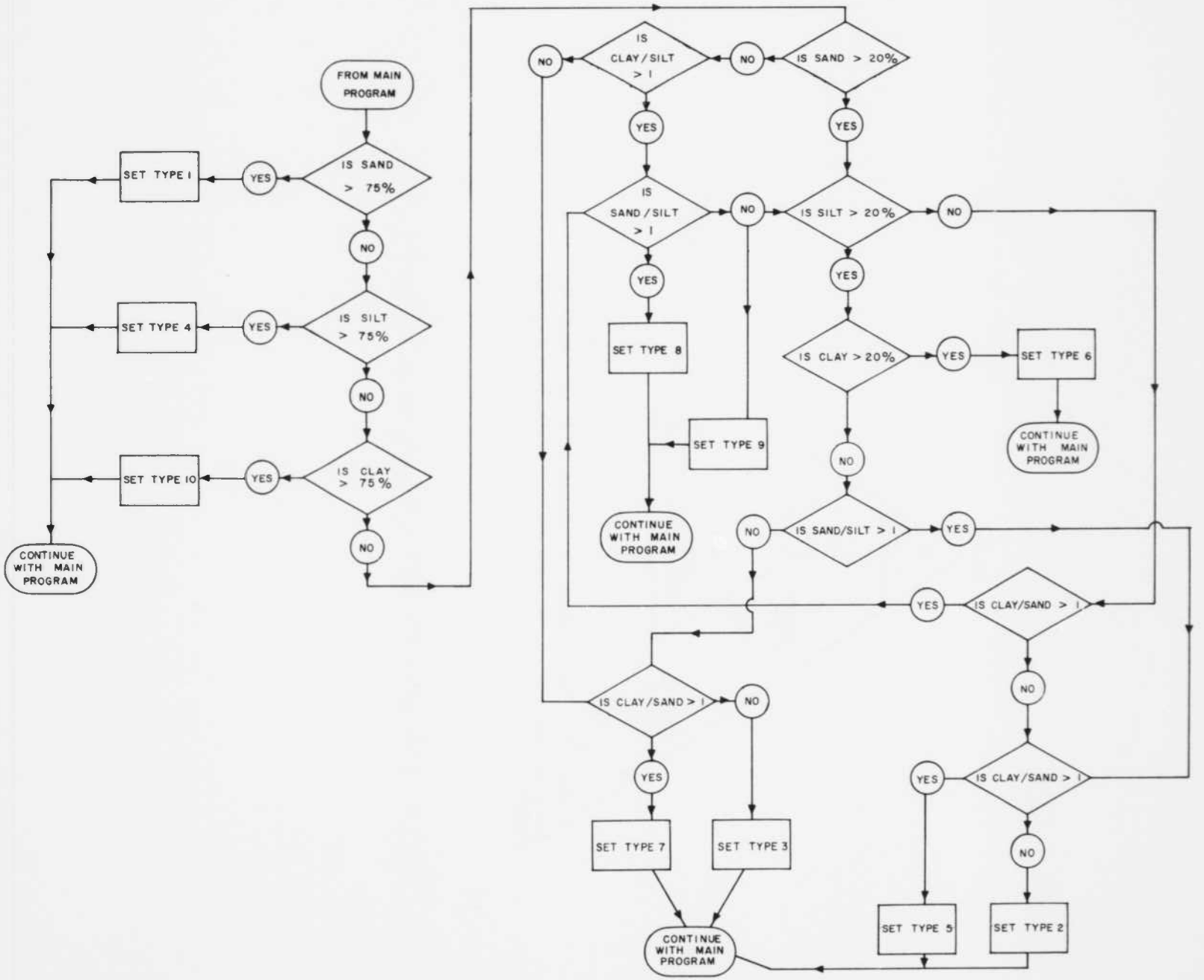

Fig. 7 Flow Chart for Determining Position of Sample on the Shepard Diagram

3.8 Trask Values

The Trask values (Krumbein and Pettijohn, 1938) computed are first, second and third quartiles (Q_1, Q_2 and Q_3) expressed in millimeters, the geometric quartile deviation (S_o), the log quartile deviation (Log SO) and the quartile skewness (SKG). The equations for these values are

$$Q_1 = e^{-\phi_{25} \log_e 2} \tag{3.9}$$

$$Q_2 = e^{-\phi_{50} \log_e 2} \tag{3.10}$$

$$Q_3 = e^{-\phi_{75} \log_e 2} \tag{3.11}$$

$$S_o = \sqrt{\frac{Q_1}{Q_3}} \tag{3.12}$$

$$SKG = \sqrt{\frac{Q_1 \cdot Q_3}{Q_2^2}} \tag{3.13}$$

$$\text{Log SO} = \log_{10} S_o \tag{3.14}$$

where ϕ_{25}, ϕ_{50} and ϕ_{75} are the phi-sizes at the 25, 50 and 75 percentile levels. An output statement is prepared at the completion of these calculations.

3.9 Inman Values

The Inman statistics (Inman, 1952) computed are the median (Md ϕ), mean (M ϕ), deviation or sorting ($\sigma\phi$), and skewness ($\alpha\phi$). If the next-to-last accumulated percentage is greater than 92, the second skewness ($\alpha 2\phi$) and kurtosis ($\beta\phi$) are also computed. The equations are the following:

$$\text{Md } \phi = \phi_{50} \tag{3.15}$$

$$\text{Md } \phi = 1/2 \cdot (\phi_{16} + \phi_{84}) \tag{3.16}$$

$$\sigma\phi = 1/2 \cdot (\phi_{84} - \phi_{16}) \tag{3.17}$$

$$\alpha\phi = \frac{\text{M } \phi - \text{Md } \phi}{\sigma\phi} \tag{3.18}$$

$$\alpha_{2\phi} = \frac{\left[1/2 \cdot (\phi_5 + \phi_{95})\right] - \text{Md}\,\phi}{\sigma_\phi} \qquad (3.19)$$

$$\beta_\phi = \frac{\left[1/2 \cdot (\phi_{95} - \phi_5)\right] - \phi}{\sigma\,\phi} \qquad (3.20)$$

when ϕ_5, ϕ_{16}, ϕ_{50}, ϕ_{84} and ϕ_{95} are the phi-values at percentile levels of 5, 16, 50, 84, and 95. If the second skewness ($\alpha_{2\phi}$) and kurtosis ($\beta\phi$) cannot be calculated the IBM 650 program substitutes 99.99 for these values and the IBM 709 omits these calculations and states this fact with a comment.

3.10 Folk and Ward Values

The Folk and Ward statistics (Folk and Ward, 1957) computed are the mean (Mz), the inclusive graphic standard deviation (σ_1), skewness (Sk) and kurtosis (Kg) from the equations

$$Mz = (\phi_{16} + \phi_{50} + \phi_{84}) \div 3 \qquad (3.21)$$

$$\sigma_1 = \frac{\phi_{84} - \phi_{16}}{4} + \frac{\phi_{95} - \phi_5}{6.6} \qquad (3.22)$$

$$SK = \frac{\phi_{16} + \phi_{84} + 2\phi_{50}}{2(\phi_{84} - \phi_{16})} + \frac{\phi_5 + \phi_{95} - 2\phi_{50}}{2(\phi_{95} - \phi_5)} \qquad (3.23)$$

$$Kg = \frac{\phi_{95} - \phi_5}{2.44\,(\phi_{75} - \phi_{25})} \qquad (3.24)$$

After each of these values, except the mean, is computed, the result is given a type number as stated in Tables 12, 13 and 14. An output statement of these results is prepared before the program goes to the initializing block.

3.11 Initializing

Before each sample is read, the words in memory used for the storage of phi size, fraction percentage and accumulated percentages are set to 999.99. Also, many locations are set back to their original condition because of address modification during the computations. After initializing, the program reads the data contained in the first card of the next sample and the process is repeated beginning with section 3.5.

TABLE 12

FOLK AND WARD CODE FOR STANDARD DEVIATION

Code	Range of Standard Deviations		Verbal Scale
	From	To	
1	0.00	0.34	very well sorted
2	0.35	0.50	well sorted
3	0.51	1.00	moderately sorted
4	1.01	2.00	poorly sorted
5	2.01	4.00	very poorly sorted
6	over 4.00		extremely poorly sorted

TABLE 13

FOLK AND WARD CODE FOR SKEWNESS

Code	Range of Skewness		Verbal Scale
	From	To	
1	-1.00	-0.30	very negative-skewed
2	-0.30	-0.10	negative-skewed
3	-0.10	0.10	nearly symmetrical
4	0.10	0.30	positive-skewed
5	0.30	1.00	very positive-skewed

TABLE 14

FOLK AND WARD CODE FOR KURTOSIS

Code	Range of Kurtosis		Verbal Scale
	From	To	
1	0.65	0.90	platykurtic
2	0.91	1.11	nesokurtic
3	1.12	1.50	leptokurtic
4	1.51	3.00	very leptokurtic
5	over 3.00		extremely leptokurtic

3.12 Differences between the 650 and 709 programs

The major difference between the 650 and 709 sediment description programs is the method of output. The 650 produces cards only while the 709 produces a written output. Other differences in the programs are in the method of writing the output statements. The 709 writes more comments, explaining if data are missing or what computations could not be made for insufficient values. Also, in case of errors detected in the sample, the 709 program writes an error statement indicating the nature of the error and its location and then bypasses any further calculation on that sample.

3.13 Time required to process samples

If the 650 is used to process the samples, the computer time required to process a typical sample containing 17 size classes is 26 seconds. In addition, one and one-half minutes are required to load the program into storage. After the output is obtained, about three minutes per sample are required on the peripheral equipment to prepare the output. Thus, a good average time per sample, is about five minutes from the time the computations are begun until the finished output is obtained.

The time required to process the same sample on the 709 computer is approximately 4.5 seconds, including the preparation of the output tape. The printing time on the peripheral equipment is the same as for the 650 output, unless a faster printing device such as an IBM 1401, is available; in which case the printing time can be reduced to 1.5 second per sample with the page setting.

4. MOMENT MEASURE PROGRAM (No. 0214)

4.1 General Description

Another method of describing the particle size distribution of sediments is the method of moment measures which is described in detail in standard statistical textbooks (Mood, 1950; Herdan, 1960; Miller and Kahn, 1962). The equations defining the first moment about the origin (the mean), the second moment about the mean (the variance), the third moment about the mean (the skewness), and the fourth moment about the mean (the kurtosis) can be written in several forms, depending upon, for example, whether the distribution is by number or by weight of particles. For the weight distribution obtained in sediment studies, the moments may be defined as:

Mean:
$$\bar{X} = \frac{1}{100} \sum fxi \qquad (4.1)$$

Standard Deviation:
$$\sigma = \sqrt{\sum f \ (X_i - \bar{X})^2 \ / \ 100} \qquad (4.2)$$

Skewness: $$\alpha_3 = \frac{1}{100}\sigma^{-3}\sum f\ (X_i - \bar{X})^3 \qquad (4.3)$$

Kurtosis: $$\alpha_4 = \frac{1}{100}\sigma^{-4}\sum f\ (X_i - \bar{X})^4 \qquad (4.4)$$

where X_i is the midpoint value of the size class and f is the fraction percentage for that class.

4.2 Computer Coding

The Moment Measure Program was coded in FORTRAN and it is listed in Appendix 5. The conversion subroutine BTSNU (see Appendix 6) must be included after the FORTRAN program.

4.3 Computation Performed by the Program (see flow chart, Figure 8)

Although the four moments are defined by the equation in section 4.1, the computation of the moments is based on a short method using the variable "u". This variable is a linear transformation of the midpoints, X_i of the classes, and is obtained by the following equation:

$$u = \frac{(X_i - X_o)}{\omega} \qquad (4.5)$$

where X_o is a class mark chosen near the mean of the distribution, and ω is the class interval.

Using the variable "u" instead of X_i, we can now compute the moments of the distribution around the point X_o. These moments, V_i, are defined as:

$$V_i = \frac{\sum u_i f}{\sum f}, \quad (i = 1,2,3,4), \qquad (4.6)$$

where V_i is the i^{th} moment about X_o, and f is the percentage frequency in each class.

From these moments of the distribution about X_o, it is possible to compute the first moment about the origin of the distribution and the second, third, and fourth moments about the mean. However, since no measure of the class interval, , is included, these moments are called "data moments", M_i, and are defined as follows:

First Data Moment: $$m_1 = v_1 + x_o \qquad (4.7)$$

Second Data Moment: $$m_2 = v_2 - v_1^2 \qquad (4.8)$$

Third Data Moment: $$m_3 = v_3 - 3v_1v_2 + 2v_1^3 \qquad (4.9)$$

Fourth Data Moment: $$m_4 = v_4 - 4v_1v_3 + 6v_1^2v_2 - 3v_1^4 \qquad (4.10)$$

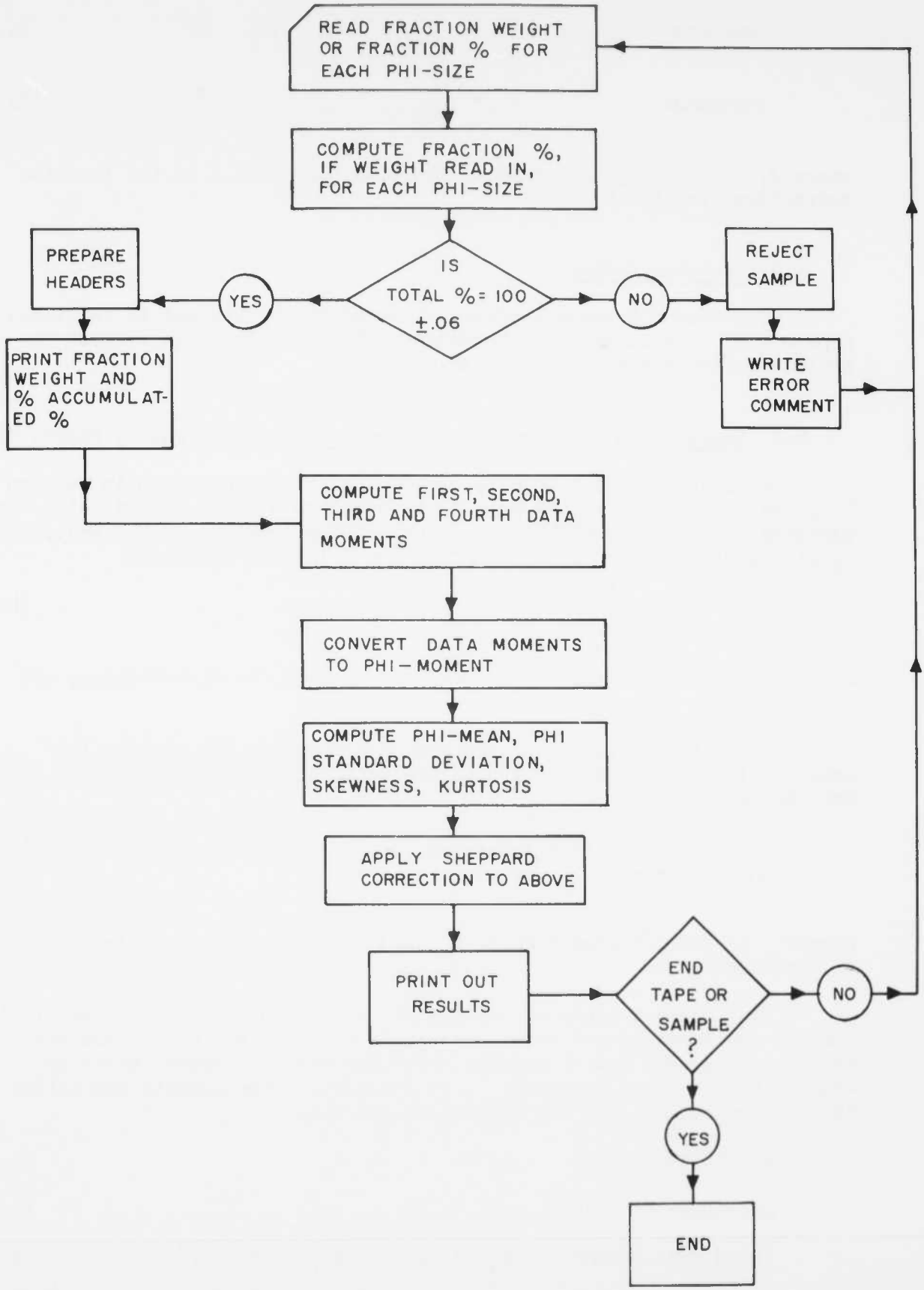

Fig. 8 Flow Chart for Moment Measure Program

These moments must now be changed to Phi Moments, P_i, in order to describe the distribution in values of phi notation as follows:

$$P_i = \omega^i m_i \quad (i = 1,2,3,4) \tag{4.11}$$

where P_i is the i^{th} Phi Moment, m_i is the i^{th} Data Moment, and ω is the class interval in phi-units (1/4, 1/2, 1, . . .)

The first four Phi Moments are defined as:

Phi Mean (First Phi Moment): $\bar{X}_\phi = P_i$ (4.12)

Phi Standard Deviation: $S_\phi = \sqrt{P_2}$ (4.13)

Phi Skewness: (Third Phi Moment) (Third Alpha Moment) $\alpha_3 = p_3 / (p_2)^{3/2}$ (4.14)

Phi Kurtosis: (Fourth Phi Moment) (Fourth Alpha Moment) $\alpha_4 = p_4 / (p_2)^2$ (4.15)

Because the data are grouped into classes, a correction called Shepard's Correction must be applied to second and high Data Moments. The effect of the class width on the mean, $\bar{X}$, is usually negligible (Topping, 1955, p. 43). The corrections which are applied to the Data Moments are:

Shepard Correction for Second Data Moment:

$$M_2' = M_2 - \frac{1}{12}\omega_i^2 \tag{4.16}$$

Shepard Correction for Fourth Data Moment:

$$M_4' = M_4 - \frac{1}{2}\omega_i^2 M_2 + \frac{7}{240}\omega_i^4 \tag{4.17}$$

where M_2' is the corrected Second Data Moment, and M_4' is the corrected Fourth Data Moment.

The Corrected Data Moments are now converted to Corrected Phi Moments by the equation:

$$P_i' = \omega_i m_i' \tag{4.18}$$

where P_i is the corrected i^{th} Phi Moment.

The Corrected Phi Moments are then expressed as:

Corrected Phi Standard Deviation: $S_\phi' = \sqrt{P_2'}$ (4.19)

Corrected Phi Skewness: $$\alpha_3' = P_3 / (P_2')^{3/2} \qquad (4.20)$$

Corrected Phi Kurtosis: $$\alpha_4' = P_4' / (P_2')^2 \qquad (4.21)$$

4.4 Input Data and Output

The detail cards described in section 2.2.2 are the input to this program. Error checks and conversion of the input data are identical to the program block described in detail in sections 3.3 and 3.4 of the Sediment Description Program. A count of the cards is made by the program and stored for the purpose of obtaining mean values of the size classes.

The output of the results is in written form as shown in Figure 9. No card output is planned but may be added by appropriate addition to the FORTRAN program.

4.5 Timing

The computer time required to process a typical sample of 17 size classes is 4 seconds, including preparation of the output tape. Printing time on the 1401 is 6 seconds per sample.

5. CONCLUSION

Two basic types of programs for electronic data processing of data from particle size analysis of sediments have been described in this report. The purpose of these programs is to alleviate the tedium of the computations for the geologist and to increase precision by minimizing the chances for operator error. The compatibility of the output values with hand calculations was demonstrated by Creager, McManus, and Collias (1962).

With regard to selection of the appropriate basic program type (sediment description or moment measure) for data processing of analyses, no set rule can be given. The choice is that of the investigator. If the graphic measures from the sediment description programs are considered to be approximations of the moment measures, then the moment measures may be preferred. If, on the other hand, as Friedman (1962, p. 742) notes, both measures are considered simply as descriptive measures, then they are equally valid.

Usually, the graphic measures are considered to be approximations of the moment measures, and as such are referred to as Inefficient Statistics (Dixon and Massey, 1957, p. 264-267). It was in the sense of approximations to the moment measures that Inman (1952) and Folk and Ward (1957) proposed their percentile estimates, although the numbers obtained in these estimates are, of course, not directly comparable with the numbers of the moment measures.

CRUISE BB 236 STATION 010 EXID 02

SAMPLER TYPE SG DATE 08/03/59 LAT. 67-21.0N LONG. 166-47.0W
DEPTH FROM TOP OF CORE 00310 MM LENGTH OF CORE 01750 MM

PHI SIZE	FRACTION PERCENT	ACCUMULATED PERCENT
-2.00	0.00	0.00
-1.00	0.16	0.16
0.00	0.03	0.19
1.00	0.07	0.26
2.00	0.17	0.43
3.00	0.90	1.33
4.00	10.93	12.26
5.00	48.46	60.72
6.00	15.77	76.49
7.00	8.63	85.12
8.00	4.76	89.88
9.00	2.98	92.86
10.00	2.68	95.54
11.00	1.19	96.73
12.00	3.27	100.00

FIRST DATA MOMENT = 5.173

SECOND DATA MOMENT = 2.382

THIRD DATA MOMENT = 4.499

FOURTH DATA MOMENT = 30.843

CONVERSION OF DATA MOMENTS TO PHI MOMENTS.

5.173 2.382 4.499 30.843

PHI STANDARD DEVIATION = 1.543

PHI MEAN = 5.173

SKEWNESS (THIRD ALPHA MOMENT) = 1.224

KURTOSIS (FOURTH ALPHA MOMENT) = 5.435

SHEPPARD CORRECTION FOR SECOND DATA MOMENT = 2.299

SHEPPARD CORRECTION FOR FOURTH DATA MOMENT = 29.681

CONVERSION OF CORRECTED DATA MOMENTS TO CORRECTED PHI MOMENTS.

2.299 29.681

CORRECTED PHI STANDARD DEVIATION = 1.516

CORRECTED SKEWNESS = 1.291

CORRECTED KURTOSIS = 5.617

Fig. 9 Example of Output from Moment Measure Program

The efficiency of the percentile estimates of the moment measures, at least for the mean and standard deviation, may be found in the works of Yost (1948), Dixon and Massey (1957, p. 404-405), and McCammon (1962b). An empirical comparison of the percentile estimates of standard deviation as an indicator of sorting of sediment particles is reported by Friedman (1962). An examination of these relationships, and the consideration of the graphic measures as approximations of the percentile estimates would suggest that the moment program provides data for a more meaningful interpretation of the sediment history and environment. Yet, there are three qualifying statements that must be considered:

1) moment measures are valid only if the sediment particle sizes are lognormally distributed, but as has been shown by Tanner (1958), Fuller (1961), and others, the sizes of sediment particles are not always lognormally distributed;

2) as noted by McCammon (1962a), the first four moments of a size frequency distribution do not necessarily characterize its shape; and

3) until a more fundamental significance of sediment size analyses is determined than merely the identification of geographic groupings of sedimentary environments, no final decision among moment measures, graphic measures, or other measures is possible.

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APPENDIX 1

Wiring of control panel for the type 533 Read-Punch unit

Rather than show a wiring diagram, the wiring for the type 533 read-punch unit will be described. The wiring is straight forward except in one case involving the punch code selectors which require the use of filters not included in the 533 unit.

Cols 1-5 First reading to Alphabetic first read W1	A23-27 to AK13-17
Cols 6-10 First reading to Alphabetic first read W2	A28-32 to AK18-22
Col 45 First reading to pilot selector X PU-2	C27 to E24
Col 55 First reading to pilot selector X PU-3	C37 to E25
Col 65 First reading to pilot selector X PU-4	D27 to E26
Col 75 First reading to pilot selector X PU-5	D37 to E27
Col 80 First reading split wired to LOAD and pilot selector X PU-1	D42 to E23 and B22
Pilot selectors 1-5 transfer to Read impulse 9	H23-27 to V33
Pilot selectors 1-5 normal to Read impulse 8	J23-27 to V34
Pilot selectors 1-5 common to Storage entry C word 10	K23-27 to AJ17-21
Pilot selector hold 1-5 to Read hold	P23-27 to T39
Read card C 1-5 to Storage entry C word 1 (1-5) (see note 1)	X1 - 5 to AE6 -10
Read card C 6-10 to Storage entry C word 2 (1-5) (see note 1)	X6 -10 to AE17-21
Read card C 11-20 to Storage entry C word 3	X11-20 to AF1 -10
Read card C 21-30 to Storage entry C word 4	X1 -10 to AF12-21
Read card C 31-40 to Storage entry C word 5	Y11-20 to AG1 -10
Read card C 41-50 to Storage entry C word 6	Z1 -10 to AG12-21
Read card C 51-60 to Storage entry C word 7	Z11-20 to AH1 -10
Read card C 61-70 to Storage entry C word 8	AA1-10 to AH12-21
Read card C 71-80 to Storage entry C word 9	AA11-20 to AJ1-10
Read sign over units is jackplugged	V24 to W24
Word size emitter 10 to word size entry C W1, W2, W3, W4, W5, W6, W7, W8 and W9	AK11 to AQ1 - 9
Word size emitter 5 to word size entry C W10	AK6 to AQ10
Constant Alphabetic Impulse (CAI) to Alphabetic in W1 and W2	AK12 to AL11-12
Punch sign over units (PSU) exit split wired to PSU entry and Alphabetic out W1 and W2	W41 to V41 and AK53 and AL53
Storage Exit C word 1 (1-5) to Punch card C 1-5	AE48-52 to X45-49
Storage Exit C word 2 (1-5) to Punch card C 6-10	AE59-63 to X50-54
Storage Exit C word 3 to Punch Card C 11-20	AF43-52 to X55-64
Storage Exit C word 4 to Punch Card C 21-30	AF54-63 to Y45-54
Storage Exit C word 5 to Punch Card C 31-40	AG43-52 to Y55-64
Storage Exit C word 6 to Punch card C 41-50	AG54-63 to Z45-54
Storage Exit C word 7 to Punch card C 51-60	AH43-52 to Z55-64
Storage Exit C word 8 to Punch card C 61-70	AH54-63 to AA45-54
Storage Exit C word 9 to Punch card C 71-80	AJ43-52 to AA55-64

Note 1 - Storage entry C words 1 and 2 are wired for alphameric information

Control information 2-5 to Punch code selectors I PU 2-5	AM60-63	to AN60-63
X-impulse to Punch code selectors common 2-5	AR54	to AR60-63
Punch code selector transfer 5 to filter (see note 2) to Punch card C 45 by split wire	AP60	to Z 49
Punch code selector transfer 4 to filter to punch card C 55 by split wire	AP61	to Z 59
Punch code selector transfer 3 to filter to punch card C 65 by split wire	AP62	to AA49
Punch code selector transfer 2 to filter to punch card C 75 by split wire	AP63	to AA59

Note 2 - If commercial filters are not available, a 1N538 silicon rectifier may be used with the base connection going to the Punch card C entry.

APPENDIX 2

Wiring of control panel for the IBM 407 tabulator

A) TRANSFER PRINT

1) Second Read: 13-75 (G 13-40 and H 1-35) to
Tr. Pr.: 32-94 (S 32-40 and U 1-14)

2) Tr. Pr. Control: First Read Col. 80 (B 40) to Com. "A" Digit Sel. (A 41)
"9" of "A" Digit Sel. (M 42) to D.P.U. P. Sel. 15 (F 67).
Coupling Exit P. Sel. 15 (C 67) to Tr. Pr. P. U. (R 40).

Note: All header cards (9 punch col. 80) print in Tr. Pr. First Read

Note: First Read Hubs are used for machine control only.

D.P.U. of P. Sel. 15 (G 67) to I.P.U. P. Sel. 18 (H 70).
First Read Col. 30 to Com. Hub P. Sel. 18 (K 70).
Norm. Hub. P. Sel. 18 (J 70) to Com. Hub "B" Digit Sel. (A 44).

3) Digit Sel. "A" (Under First Read Control)
7 Hub (K 42) to I.P.U. P. Sel. 20 (H 72).
8 Hub (L 42) to D.P.U. P. Sel. 8 (G 60).

4) Digit Sel. "B" (Under First Read Control)
0 (Zero) Hub (D 43) to 1 (One) Hub (E 43).
1 (One) Hub (E 44) to D.P.U. P. Sel. 1 (One) (G 53).
2 Hub (F 44) to D.P.U. P. Sel. 2 (F 54).
3 Hub (G 44) to D.P.U. P. Sel. 3 (G 55).
D.P.U. P. Sel. 3 (F 55) to I.P.U. P. Sel. 16 (H 66).
4 Hub (H 44) to D.P.U. P. Sel. 4 (F 56).
5 Hub (I 44) to D.P.U. P. Sel. 5 (G 57).
6 Hub (J 44) to D.P.U. P. Sel. 6 (G 58).
7 Hub (K 44) to D.P.U. P. Sel. 7 (G 59).

Note: The above impulses are control punches punched in Col. 30 of "Detail" Cards.

Col. 30 is wired from First Read through Com. and Norm. of P. Sel. 18 to the Com. Hubs of digit selector B.

Continuation of First Read Control Punches.
40 Hub (A 40) to Transfer Hub Co-Sel. 14 (Z 51).
Com. Hub Co-Sel. 14 (AB 51) to Com. P. Sel. 14 (N 66).
Tr. P. Sel. 14 (L 66) to Norm. P. Sel. 11 (M 63).
Com. P. Sel. 11 (N 63) to D.P.U. P. Sel. 13 (G 65).
First Read Hub 77 (B 37) to Com. Co-Sel. 14 (AB 50).

Tr. Co-Sel. 14 (Z 50) to I.P.U. P. Sel. 17 (H 69).
First Read Hub 78 (B 38) to X.P.U. P. Sel. 20 (D 72).
First Read Hub 79 (B 39) to X Carriage Skip One (I 31).
Co-Sel. Pick-Up
Coupling Exit Impulses From P. Sel.
Coupling Exit P. Sel. 1 (C 53) to Co-Sel. P.U. 9 and 10 (A 61) and (B 62 to A 62).

2 (C 54) to Co-Sel. P.U. 15, 16, 17, 18, and 19. (A 67): B 68 to A 68, B 69 to A 69, B 70 to A 70, B 71 to A 71).

3 (C 55) to Com. P. Sel. 11 (K 63).
Norm. P. Sel. 11 (J 63) to Co-Sel. P.U. 8 (A 60).

4 (C 56) to Co-Sel. P.U. 4 (B 57) and Co-Sel. P.U. 1 and 2 (A 56 to A 53, B 54 to A 54).

5 (C 57) to Co-Sel. P.U. 5 (A 57).

6 (C 58) to Co-Sel. P.U. 6 (A 58).

7 (C 59) to Co-Sel. P.U. 20, 21, 22, Alter Switch 2 Com. and Tr., and Co-Sel. P.U. 28. (A 72, B 73 to A 73, B 74 to A 74, B 75 to G 74, E 74 to A 80).

13 (C 65) to Co-Sel. P.U. 7 and D.P.U. P. Sel. 12. (A 59, B 60 to F 64).

15 (R 39) to Co-Sel. P.U. 27 (A 79).

Major First Card (ø 73) to Co-Sel. P.U. 3 and 29. (B 56, A 55 to C 73).
Prog. Cpl. 4 (AS 69) to Filter Entry 10 (BK 24)
Filter Exit 10 (BL 24) to Prog. Cpl. 3 (AR 69).
Prog. Cpl. 3 (AR 70) to Co-Sel. P.U. 29 (D 74).
Card Cycles (ø 71) to Com. P. Sel. 19 (N 71).
Tr. P. Sel. 19 (L 71) to Co-Sel. P.U. 11, 12, and 13. (A 63, B 64 to A 64, B 65 to A 65).

B) DETAIL CARD WIRING

From Second Read

36-39 (AC 36-39) to Tr. Co-Sel. 15 (Aø 2-5)
Com. Co-Sel. 15 to Norm. Co-Sel. 10 (X 49-52).
Com. Co-Sel. 10 to N.P.E. 51-55 (W 11-15).
42-45 (AE 2-5) to Tr. Co-Sel. 16 (Aø 7-10).
Com. Co-Sel. 16 (AQ 7-10) to N.P.E. 60 - 64 (W 60 -64).
46-50 (AE 6-10) to Tr. Co-Sel. 17 (Aø 11-15).
Com. Co-Sel. 17 (AQ 11-15) to N.P.E. 68-73 (W 28-33).

42-45 (AE 2-5) to Prog. Sel. L. 1 (I 1-4).
Com. Prog. Sel. (N 1-4) to N.P.E. 33-37 (V 33-37).
47-50 (AE 7-10) to Prog. Sel. L. 1 (I 6-9)
Com. Prog. Sel. (N 6-9) to Norm. Co-Sel. 28 (BA 56-60).
Com. Co-Sel. 28 (BB 56-60) to N.P.E. 42-46 (W 2-6).
52-55 (AE 12-15) to Prog. Sel. L. 1 (I 11-14)
Com. Prog. Sel. (N 11-14) to Norm. Co-Sel. 15 (AP 2-5).
57-60 (AE 17-20) to Prog. Sel. L. 1 (I 16-19).
Com. Prog. Sel. L. 1 (N 16-19) to Norm.Co-Sel. 20 (AP 27-30).
Com. Co-Sel. 20 (AQ 27-30) to Norm. Co-Sel. 16 (AP 7-10).
62-65 (AE 22-25) to Prog. Sel. L. 1 (I 21-24).
Com. Prog. Sel. L. 1 (N 21-24) to Norm. Co-Sel. 17 (AP 12-15).
67-70 (AE 27-30) to Norm. Co-Sel. 18 (AP 17-20).
Com. Co-Sel. 18 (AQ 17-20) to Norm. Co-Sel. 21 (AP 32-35).
Com. Co-Sel. 21 (AQ 32-35) to N.P.E. 78-82 (W 38-40, X 1-2).
72-75 (AE 32-35) to Norm. Co-Sel. 19 (AP 22-25).
Com. Co-Sel. 19 (AQ 22-25) to Norm. Co-Sel. 6 (Q 67-70).
Com. Co-Sel. 6 (R 67-70) to Norm. Co-Sel. 5 (Q 62-65).
Com. Co-Sel. 5 (R 62-65) to N.P.E. 86-90 (X 6-10).
41-45 (AF 1-5) to Prog. Sel. L. 2 (J 1-5).
Com. Prog. Sel. (N 1-5) to N.P.E. 33-38 (V 33-38).
46-50 (AF 6-10) to Prog. Sel. L. 2 (J 6-10).
Com.Prog. Sel. (N 6-9) to Norm. Co-Sel. 28 (BA 56-60).
Com. Prog. Sel. (N 10) to N.P.E. 47 (W 7).
51-55 (AF 11-15) to Prog. Sel. L. 2 (J 11-15)
Com. Prog. Sel. (N 11-14) to Norm.Co-Sel. 15 (AP 2-5).
Com. Prog. Sel. (N 15) to N.P.E. 56 (W 16).
56-60 (AF 16-20) to Prog. Sel. L. 2 (J 16-20).
Com. Prog. Sel. (N 16-19) to Norm Co-Sel. 20 (AP 27-30).
Com. Prog. Sel. (N 20) to N.P.E. 65 (W 25).
61-65 (AF 21-25) to Prog. Sel. L. 2 (J 21-25).
Com. Prog. Sel. (N 21-24) to Norm. Co-Sel. 17 (AP 12-15)
Com. Prog. Sel. (N 25) to N.P.E. 74 (W 34).

C) WIRING FOR PROOF READ INPUT CARDS

From Second Read
1- 5 (AC 1-5) to Com. Co-Sel. 11 (AB 33-37).
Tr. Co-Sel. 11 (Z 33-37) to N.P.E. 1-5 (V 1-5).
6- 8 (AC 6-8) to Com. Co-Sel. 12 (AB 38-40).
Tr. Co-Sel. 12 (Z 38-40) to N.P.E. 7-9 (V 7-9).
11-12 (AC 11-12) to Com. Co-Sel. 12 (AB 41-42).
Tr. Co-Sel. 12 (Z 41-42) to N.P.E. 11-12 (V 11-12)
31-35 (AC 31-35) to Com. Co-Sel. 13 (AB 43-47)
Tr. Co-Sel. 13 (Z 43-47) to N.P.E. 15-19 (V 15-19).

D) PILOT AND CO-SELECTOR PICK-UP

Split Column Control Half After 11 Time (J 77) to Co-Sel. P.U. 23, 24, 25, and 26. (A 75, B 76 to A 76, B 77 to A 77, B 78 to A 78).
Card Cycles (ø 53) to Com. P. Sel. 1 (K 53); Tr. P. Sel. 1 (I 53) to D.P.U. P. Sel. 19 (F 71).
Card Cycles (ø 54) to Com. P. Sel. 1 (N 53); Tr. P. Sel. 1 (L 53) to Counter Entry 3A (S 55).
Counter Entry 3A (T 55) to Counter 8C (T 64).

Card Cycles (ø 63) to Com. P. Sel. 2 (N 54); Norm. P. Sel. 2 (M 54) to Com. Co-Sel. 9 (Y 47);
Norm. Co-Sel. 9 (X 47) to Com. P. Sel. 5 (K 57);
Norm. P. Sel. 5 (J 57) to Progressive Sel. Cpl. 1 (I 30).
Tr. P. Sel. 5 (I 57) to Progressive Sel. Cpl. 2 (J 30).
Second Read Hub 60 (AE 20) to Com. Col. Split (AF 48);
(11-12) Col. Split (AD 48) to Com. P. Sel. 2 (K 54).
Norm. P. Sel. 2 (J 54) to Norm. Pr. Entry 59 (W 19).
Card Cycles (ø 55) to Com. P. Sel. 3 (N 55); Tr. P. Sel. 3 (L 55) to Bus (N 50).
Card Cycles (ø 61) to Com. P. Sel. 3 (K 55); Tr. P. Sel. 3 (I 55) to Extra Space (K 76).
Card Cycles (ø 56, 57, 58) to Com. P. Sel. 4, 5, 6 (N 56, 57, 58).
Tr. P. Sel. 4, 5, 6 (L 56, 57, 58) to Bus Hubs (N 51, 52 and ø 50)
Zero Pr. Control (BL 47) to Com. P. Sel. 4 (K 56)
Norm. P. Sel. 5 (J 56) to Com. Co-Sel. 23 (AY 45)
Norm. Co-Sel. 23 (AX 45) to Bus Hubs (BK 7)
CO - CC (ø 79) to Com. P. Sel. 7 (K 59); Tr. P. Sel. 7 (I 59) to Co-Sel. P.U. 28 (D 73).
Card Cycles (ø 59) to Com. P. Sel. 7 (N 59); Tr. P. Sel. 7 (L 59) to Bus Hubs (ø 51).
Card Cycles (ø 60) Com. P. Sel. 8 (N 60); Tr. P. Sel. 8 (L 60) to Ma. Prog. Start (E 32).
Emitter (*, V 41) to Tr. P. Sel. 10 (I 62); * Symbol Exit 3A (AG 55) to Norm. P. Sel. 10 (J 62).
Com. P. Sel. 10 (K 62) to Norm. Co-Sel. 29 (BA 62).
Com. Co-Sel. 29 (BB 62) to Norm. Pr. Entry 75 (W 35).
Col. Split Cpl. (AC 52) to Co-Sel. P.U. 14 (A 66).
Second Read Hub 40 (AD 40) to Col. Split (AF 41).
Col. Split (AE 41) to Com. P. Sel. 13 (K 65).
Tr. P. Sel. 13 (I 65) to Norm. Pr. Entry Hub 93 (X 13).
Zero Pr. Control 76 (BJ 76) to Com. P. Sel. 15 (N 67).
Tr. P. Sel. 15 (L 67) to Norm. Co-Sel. 24 (AX 48).
Com. Co-Sel. 24 (AY 48) To Entry 0 (BI 36).
Card Cycles (ø 69 and 71) to Com. P. Sel. 17 and 20 (N 69 and 71).
Tr. P. Sel. 17 and 20 (L 69 and 71) split wired and taken into "Extra Space" (K 76).
P. Sel. Tr. Hub 3 (I 55) split wired with Bus Hub (ø 52) and taken into "Extra Space" (K 77).
Alter Switches
Alter Switch Ex. (H 73) to Com. Alter Sw. 1 (G 73).
Tr. Alter Sw. 1 (E 73) to D.P.U. P. Sel. 19 (F 71).
Alter Switch Exit 3 (H 75) to Com. Alter Sw. 3 (G 75);
Tr. Alter Switch 3 (E 75) to I.P.U. P. Sel. 11 (H 63).
"Ro" (G 79) to Com. Alter Sw. 4 (G 76).
Tr. Alter Sw. 4 (E 76) to "On" (H 79).

E) COUNTER CONTROLS

3A Neg. Bal. Off (AF 55) to 3A Neg. Bal. Control (AE 55).
8C Neg. Bal. Off (AF 64) to 8C Neg. Bal. Control (AE 64).
* Symbol Exit 8C (AG 64) to Norm. Co-Sel. 29 (BA 61).
Com. Co-Sel. 29 (BB 61) to Norm. Pr. Entry 76 (W 36).

Note: The * symbol from counter 8C is split wired with second read col. 70 into print wheel 76 of normal print entry. 8C is wired with second read col. 70 co.sel. 29 and col. 70 is wired through co-sel. 22 and then split wired into norm. pr. entry 76.

F) COUNTER WIRING

Carry Exit 8C (AK 64) to Carry Entry 8C (Aø 64).
Program Step 2 Inter (AQ 64) to Read Out and Reset 8C (Aø 64).
Final Total (AP 73) to Read Out and Reset 8C (AN 64).
Int. First Card (N 74) and Major First Card (ø 74) split wired and taken into Storage in "D" of Unit A.
Program Step 1, Minor, (AP 56) to Storage Out Immediate of Unit "A" (AL 47).
Stor. Out Immediate, Unit "A" (AK 47) to I.P.U. P. Sel. 10 (H 62).
Second Read Hubs 46-50 (AF 6-10) to Counter Entry 8C (AJ 17-21).
Counter Exit 8C (AU 14-21) to Counter Controlled Pr. 66-74, (BA 26-34).
Second Read Hubs 51-55 (AE 11-15) and 59-60 (AE 19-20) to Storage Entry Unit "A" (ø 12-16) and (ø 10-11).
Storage Exit Unit "A" (Y 10-16) to Counter Exit 8C (AT 15-21).
Counter Entry 8C (AJ 17-21) to Progressive Sel. L. 2, Hubs 6-10 (J 6-10).

G) WIRING AND PRINTING OF MINUS SIGNS

Second Read Col.	to Col. Splits Entry	to Col. Split Exit (11-12) Impulses
40 (AD 40)	AF 41	(AD 41) to Co-Sel. 15 Tr. (Aø 1)
40 (AC 40)	AF 44	(AD 44) to Co-Sel. 10 Tr. (W 48)
45 (AF 5)	AF 45	(AD 45) to Co-Sel. 1 Norm. (Q 41) Co-Sel. 1 Com. (R 41) to Norm. Pr. 32 (V 32).
50 (AF 10)	AF 46	(AD 46) to Co-Sel. 1 Norm. (Q 42) Co-Sel. 1 Com. (R 42) to Norm. Pr. Entry 41 (W 1).
55 (AF 15)	AF 47	(AD 47) to Co-Sel. 1 Norm. (Q 43) Co-Sel. 1 Com. (R 43) to Co-Sel. 15 Norm. (AP 1). Co-Sel. 15 Com. (AQ 1) to Co-Sel. 10 Norm. (X 48). Co-Sel. 10 Com. (Y 48) to Norm. Pr. Entry 50 (W 10).
60 (AE 20)	AF 48	(AD 48) to Com. P. Sel. 2 (K 54). Norm. P. Sel. 2 (J 54) to Norm. Co-Sel. 1 (Q 44). Com. Co-Sel. 1 (R 44) to Norm. Pr. 59 (W 19).

Second Read Col.	to	Col. Splits Entry	to	Col. Split Exit (11-12) Impulses
65 (AF 25)		AF 49		(AD 49) to Norm. Co-Sel. 17 (AP 11). Com. Co-Sel. 17 (AQ 11) to Norm. Co-Sel. 4 (Q 56). Com. Co-Sel. 4 (R 56) to Norm. Co-Sel. 1 (Q 45). Com. Co-Sel. 1 (R 45) to Norm. Pr. Entry 68 (W 28).
70 (AE 30)		AF 50		(AD 50) to Norm. Co-Sel. 2 (Q 46). Com. Co-Sel. 2 (R 46) to Norm. Pr. Entry 77 (W 37).
75 (AF 35)		AF 51		(AD 51) to Norm. Co-Sel. 4 (Q 58). Com. Co-Sel. 4 (R 58) to Norm. Pr. Entry 85 (X 5).

H) COLUMN SPLIT EXITS (0-9) IMPULSES

0-9 HUBS

AE 41	to	Norm. Pr. Entry 93 (X 13)
AE 45	to	Prog. Sel. L. 1, Hub 4 (I 4)
AE 46	to	Prog. Sel. L. 1, Hub 9 (I 9)

I) COLUMN SPLITS 0-9 EXITS

AE 47 to Prog. Sel. L. 1, Hub 14 (I 14)

AE 48 to (Split Wired to Two Different Places):

1) Co-Sel. 22 Tr. (Aø 38)
Co-Sel. 22 Com. (AQ 38) to Co-Sel. 20 Tr. (Aø 26)
Com. Co-Sel. 20 (AQ 26) to N.P.E. 60 (W 20).

2) Prog. Sel. L. 1 Hub 19 (I 19)

AE 49 to Prog. Sel. L. 1, Hub 24 (I 24)

AE 50 to (Split Wired Into Two Different Places):

1) Com. Co-Sel. 22 (AQ 39)
Tr. Co-Sel. 22 (Aø 39) is split wired into Norm. Pr. Entry 76 (W 36).

2) Norm. Co-Sel. 18 (AP 20)

AE 51 to Norm. Co-Sel. 19 (AP 25).

Second Read Col. 80 (AF 40) to Col. Split (AF 52)
(AE 52) to Com. Co-Sel. 22 (Aø 40)
Tr. Co-Sel. 22 (AQ 40) to N.P.E. 93 (X 13)

Bus Hub (BL 1) to Com. Col. Splits (AF 42)
(0-9) Col. Splits (AE 42) to Entry ϕ (BI 39).
(11-12) Col. Splits (AD 42) to (& -) BK 37.

Bus Hub (BK 1) to Com. Col. Splits (AF 43)
(0-9) Col. Splits (AE 43) to Entry ϕ (BI 40).

J) DECIMAL POINT WIRING

Decimals are emitted from "Decimal" (AC 45-48) into Normal Print Entry.

N.P.E. Print Wheels

35 (V 35)

44 (W 44) This is wired through Co-Sel. 28 (BA 58 and BB 59) norm. and com.

53 (W 53)

62 (W 62)

71 (W 71)

80 (W 80)

88 (X 88)

K) ZERO PRINT CONTROL WIRING

Z.P.C. Wiring for Forced Minus Signs and Zeroes:

Zeroes are wired from Z.P.C. to Bus Hubs (BK 1-14).
Zeroes and 11-12 zone punches are wired to Bus Hubs (BL 1-14).
A single wire is taken from (BK 1-14) to Com. of Col. Split.
"0-9" of Col. Split is wired to "Entry ϕ" Hubs.
A single wire is taken from (BL 1-14) to Com. of Col. Split.
"0-9" of Col. Split is wired to "Entry ϕ" Hubs.
"11-12" of Col. Split is wired to "&-" Hubs.
Forced zeroes and minus signs are wired through the Com. and Norm. Hubs of Co-Sel 23, 24, 25 and 26.

L) ZERO PRINT CONTROL SELECTION

ZERO PRINT CONTROL	to	SELECTION (Common Normal of Selectors)	to	BUS HUBS
32 (BH 72)		Co-Sel. 26 (BB 49, BA 49)		BL 1-14
34 (BH 74)		Co-Sel. 26 (BB 48, BA 48)		BK 1-14

ZERO PRINT CONTROL to	SELECTION (Common Normal of Selectors)	to BUS HUBS
41 (BJ 41)	Co-Sel. 26 (BB 46, BA 46)	BL 1-14
43 (BJ 43)	Co-Sel. 26 (BB 47, BA 47)	BK 1-14
50 (BJ 50)	Co-Sel. 25 (BB 45, BA 45)	BL 1-14
52 (BJ 52)	Co-Sel. 25 (BB 44, BA 44)	BK 1-14
59 (BJ 59)	Co-Sel. 25 (BB 43, BA 53)	BL 1-14
61 (BJ 61)	Co-Sel. 24 (AY 52, AX 52)	BK 1-14
68 (BJ 68)	-----	BK 40 (&-)
70 (BJ 70)	-----	BK 35 (Entry ø)
76 (BJ 76)	P. Sel. 15 (Com. & Tr., N 67, L 67) Co-Sel. 24 (AX 48, AY 48)	BI 36 (Entry ø)
77 (BJ 77)	Co-Sel. 23 (AY 46, AX 46)	BL 1-14
79 (BJ 79)	Co-Sel. 27 (BB 54, BA 54) Co-Sel. 23 (AY 47, AX 47)	BK 1-14
85 (BL 45)	Co-Sel. 23 (AY 44, AX 44)	BL 1-14
87 (BL 47)	P. Sel. 4 (K 56, J 56) Co-Sel. 23 (AY 45, AX 45)	BK 1-14

M) ZERO PRINT CONTROL JACK-PLUGGED FIELDS

Field	Jack-Plugged to	Field
BG 45		BH 45
BG 48-49		BH 48-49
BG 57-59		BH 57-59
BG 75-78		BH 75-78
BI 44-47		BJ 44-47
BI 51		BJ 51
BI 53-58		BJ 53-58
BI 60		BJ 60
BI 62-66		BJ 62-66
BI 69		BJ 69
BI 71-74		BJ 71-74
BI 80		BJ 80
BK 41-43		BL 41-43
BK 48-58		BL 48-58
BK 67-72		BL 67-72

Symbolic Listing of Sediment Description Program (# 0212) for IBM 650 Computer

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1                       IDF     0212
2                       P5C
3   1                     PROGRAM TO COMPUTE RESULTS OF
4   1                     SEDIMENT ANALYSES USED IN
5   1                     MARINE GEOLOGY
6   1
7   1                     WRITTEN BY  EUGENE E. COLLIAS
8   1
9   1                     ROUTINE 0212
10  1                     WRITTEN JANUARY 1960
11  1                     REVISED AUGUST 1960
12  1                     REVISED JANUARY 1963
13  1
14  1                     PSEUDO OPS
15  1
16  1
17                      BLR     0000    0000
18                      BLR     1686    1999    SUBROUTINS
19  1
20                      REG     R0001   0010    READ REG
21                      REG     P0027   0036    PUNCH REG
22  1
23                      REG     T1400   1499    T-TABLE
24  1
25                      REG     A1500   1549    PHI SIZES
26                      REG     B1550   1599    ACUM PRCT
27                      REG     C1600   1649    T-VALUES
28                      REG     D1650   1670    FAND W TLU
29                      REG     E1671   1680    TEMP STORG
30                      REG     M1681   1685    TMP STORAG
31  1
32                      SYN     START   0200
33  1
34                      SYN     Y1      0500    PHI TERMS
35                      SYN     Y2      0510    OF
36                      SYN     Y3      0520    INTRPOLATN
37                      SYN     Y4      0530    ROUTINE
38  1
39                      SYN     X1      0550    PERCENT
40                      SYN     X2      0560    TERMS OF
41                      SYN     X3      0570    INTRPOLATN
42                      SYN     X4      0580    ROUTINE
43  1
44                      SYN     XX      0600
45  1
46                      SYN     AA      0150
47                      SYN     AAB     0146
48                      SYN     BA      0140
49                      SYN     BAB     0136
50  1
51  1
52                      SYN     L117    0117    SEE CARDS
53                      SYN     L096    0096    0831, 0838
54  1
55                      SYN     DISTB   8001
56                      SYN     LOWER   8002
57                      SYN     UPPER   8003
58  1
59  1                     INSERT FIVE PER CARD LOADING
60  1                     ROUTINE HERE
61  1
62                      REL     9999    1700
63                      REQ     SQURT   0001
64  1                     INSERT SUBROUTINE 5001 HERE
65  1
66                      REL     9999    1750
67                      REQ     ELRGX   0000
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 68    1              INSERT SUBROUTINE 5508 HERE
 69    1
 70    1
 71                   REL     9999     1800
 72                   REQ    LOG10     0055
 73    1              INSERT SUBROUTINE 5002 HERE
 74    1
 75          START    RCD     R0011    INITL    READFIRST          0200   70 0011 0011
 76    1                                         CARD, THEN
 77    1                                         INITIALIZE
 78    1
 79          DATA1    LDD     R0001              MOVE CRUIS         0050   69 0001 0054
 80                   STD     P0001               NUMBER            0054   24 0027 0080
 81    1
 82                   LDD     R0002              MOVE STAT          0080   69 0002 0055
 83                   STD     P0002              NO + SMPLR         0055   24 0028 0081
 84    1                                          TYPE
 85    1
 86                   LDD     R0003              MOVE               0081   69 0003 0056
 87                   STD     P0003               POSITION          0056   24 0029 0082
 88    1
 89                   RAL     R0004              CHANGE             0082   65 0004 0059
 90                   SRT      0001               CARD TYPE         0059   30 0001 0015
 91                   SLT      0001               TO NO. 2          0015   35 0001 0021
 92                   ALO     TW000                                0021   15 0024 0079
 93                   STL     P0004                                0079   20 0030 0083
 94    1
 95                   RAM     R0005              SEPARATE           0083   67 0005 0109
 96                   STD     P0005               DEPTH             0109   24 0031 0084
 97                   SLT      0005                                0084   35 0005 0047
 98                   STU     E0001                                0047   21 1671 0074
 99    1
100                   RAU     R0005              AND PHI-           0074   60 0005 0159
101                   SLT      0005              SIZE               0159   35 0005 0071
102                   SRT      0006                                 0071   30 0006 0085
103                   AUP     PHI10                                0085   10 0038 0043
104                   STU     A0002                                0043   21 1501 0104
105                   STD     PHIA                                 0104   24 0057 0060
106   1
107                   RAU     R0006              IS FIRST           0060   60 0006 0061
108                   STD     B0002              PERCENT            0061   24 1551 0154
109                   NZU              OK        ZERO               0154   44 0107 0058
110   1
111                   RAU     E0004              NO SO STOP         0107   60 1674 0129
112                   ALO     DISTB    DISTB                       0129   15 8001 8001
113         E0004     HLT      1999    START                        1674   01 1999 0200
114   1
115         OK        ALO     SUMMP                                0058   15 0111 0065
116                   STL     P0006                                0065   20 0032 0135
117   1
118                   RSL     4.090              SET FIRST          0135   66 0088 0093
119                   STL     P0007              T-VALUE            0093   20 0033 0086
120                   STD     C0002              TO -4.090          0086   24 1601 0204
121   1
122                   RAU     R0007              CHECK IF           0204   60 0007 0161
123                   SRT      0005              POST               0161   30 0005 0023
124                   STU     PAWT               ANALYTICAL         0023   21 0078 0131
125                   RAU     LOWER              WEIGHT             0131   60 8002 0039
126                   AUP     PAWT               EXCEEDS            0039   10 0078 0133
127                   STU     PAWT               100 GRAMS          0133   21 0078 0181
128   1
129                   PCH     P0001              PUNCH CARD         0181   71 0027 0077
130   1
131                   LDD     ONEEE              SET CARD           0077   69 0130 0183
132                   STD     CRDCT    DATA2     COUNT = 1          0183   24 0186 0089
133   1
134         DATA2     RCD     R0001              READ NEXT          0089   70 0001 0051
135   1                                          DATA CARD
136   1
137   1              CHECK IF THIS IS THE SAME SMPL
138   1
139                   RAU     R0001              IS THIS            0051   60 0001 0105
140                   SUP     P0001              THE SAME           0105   11 0027 0231
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141                NZU   LAST              CRUISE          0231  44 0185 0236
142  1
143                RAU   R0003             YES, SO IS      0236  60 0003 0157
144                SUP   P0003             EXTRA ID        0157  11 0029 0233
145                NZU   LAST              THE SAME        0233  44 0185 0138
146  1
147                RAU   R0002             YES, SO IS      0138  60 0002 0207
148                SUP   P0002             STAT NO         0207  11 0028 0283
149                NZU   LAST              THE SAME        0283  44 0185 0188
150  1
151                RAM   R0005             YES, SO IS      0188  67 0005 0209
152                STD   P0005             SAME DEPTH      0209  24 0031 0134
153                SLT    0005             AS ON           0134  35 0005 0097
154                SUP   E0001             FIRST CARD      0097  11 1671 0025
155                NZU   LAST                              0025  44 0185 0180
156  1
157  1
158                RAU   R0005             SAME            0180  60 0005 0259
159                SLT    0005             SAMPLE SO       0259  35 0005 0121
160                SRT    0006             MOVE PHI        0121  30 0006 0235
161                AUP   PHI10   AA111      AND ADD         0235  10 0038 0143
162          AA111 STU   A0003   AA11       TEN TO IT       0143  21 1502 0155
163          AA11  STD   PHIB                               0155  24 0108 0211
164  1
165                RAL   PHIA              IS PHIB         0211  65 0057 0261
166                SLO   PHIB              LARGER          0261  16 0108 0013
167                BMI   E0006             THAN PHIA       0013  46 1676 0017
168  1
169                RAU   E0005             PHIB IS         0017  60 1675 0179
170                SLO   DISTB   DISTB      SMALLER         0179  16 8001 8001
171          E0005 HLT    1999   START      SO STOP         1675  01 1999 0200
172  1
173          E0006 STD   PHIA              PHIB            1676  24 0057 0110
174  1                                     LARGER SO
175                RAL   R0006             SEPARATE        0110  65 0006 0311
176                SLT    0005             PERCENT         0311  35 0005 0073
177  1
178                NZU   A12               IS IT ZERO      0073  44 0127 0128
179  1
180                RAU   R0007             YES, SO         0128  60 0007 0361
181                SLT    0005             CALCULATE       0361  35 0005 0123
182                RAL   UPPER             PERCENT         0123  65 8003 0281
183                SLT    0002             FROM            0281  35 0002 0037
184  1
185                RAU   UPPER             FRACTION        0037  60 8003 0045
186                SLT    0005             WEIGHTS         0045  35 0005 0257
187                AUP   R0006                             0257  10 0006 0411
188                SRT    0003                             0411  30 0003 0019
189                DVR   PAWT                              0019  64 0078 0139
190                SRD    0003                             0139  31 0003 0049
191                SLT    0005                             0049  35 0005 0461
192                STL   R0006                             0461  20 0006 0309
193                SLT    0005   A12                       0309  35 0005 0127
194  1
195          A12   AUP   SUMMP   AA222      NO, SO          0127  10 0111 0115
196          AA222 STU   B0003   A22        ACCUMULATE      0115  21 1552 0205
197          A22   STD   SUMMP              PERCENT         0205  24 0111 0014
198  1
199                RAL   R0006             STORE           0014  65 0006 0511
200                SRT    0005             FRACTION        0511  30 0005 0173
201                SLT    0005             PERCENT         0173  35 0005 0285
202                ALO   SUMMP             AND ACCUMD      0285  15 0111 0165
203                STL   P0006             PERCENT         0165  20 0032 0335
204  1
205  1
206                RAL   SUMMP             CALCULATE       0335  65 0111 0215
207                SLO   PC100              T-VALUE         0215  16 0018 0223
208                BMI   NGPC               FROM ACCM       0223  46 0026 0177
209  1                                     PERCENT
210                RAL   4.090             BUT CHECK       0177  65 0088 0193
211                STD   DLPC    ZHH        FOR SUMMP       0193  24 0046 0099
212  1                                     = 100.00
213          NGPC  ALO   DISTB              OR              0026  15 8001 0333
```

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214                SLO   PC050          50.00          0333  16 0286 0041
215                NZE   NT50    ZHH                  0041  45 0044 0099
216          NT50  STL   DLPC                          0044  20 0046 0149
217    1
218                RAM   LOWER                         0149  67 8002 0307
219                STL   DLPM                          0307  20 0561 0064
220                SLT    0005                         0064  35 0005 0227
221                STL   DLPT                          0227  20 0331 0184
222    1
223                RAL   ZEROS          USE TLU TO     0184  65 0087 0091
224                LDD   DLPT           FIND           0091  69 0331 0234
225                TLU   T0001          NEAREST        0234  84 1400 0255
226                LDD   ZA             T-VALUE        0255  69 0158 0611
227                SDA   ZA       ZA                   0611  22 0158 0158
228          ZA    RAL   T0001                         0158  65 1400 0305
229                SLT    0005                         0305  35 0005 0067
230                STU   XX2            XX = PRCT      0067  21 0022 0075
231                RAL   LOWER                         0075  65 8002 0383
232                SLT    0005                         0383  35 0005 0095
233                STU   YY2            YY = T         0095  21 0100 0053
234    1
235                RAL   ZA                            0053  65 0158 0063
236                SLO   DA001                         0063  16 0016 0171
237                LDD   ZB                            0171  69 0124 0277
238                SDA   ZB       ZB                   0277  22 0124 0124
239          ZB    RAL   T0001   ZC                   0124  65 1400 0355
240          ZC    NZE   ZH                           0355  45 0208 0359
241    1
242                RAL   ZB             DOES DA        0359  65 0124 0229
243                SLO   DA002          OF ZB          0229  16 0132 0137
244                STL   ZB             = 1400         0137  20 0124 0327
245                SLO   ZD                           0327  16 0230 0385
246                NZE   ZB       ZH                   0385  45 0124 0208
247    1
248          ZH    SLT    0005                         0208  35 0005 0221
249                STU   XX1                           0221  21 0076 0279
250                RAL   LOWER                         0279  65 8002 0187
251                SLT    0005                         0187  35 0005 0199
252                STU   YY1                           0199  21 0254 0357
253    1
254                RAL   XX1            INTERPOLAT     0357  65 0076 0381
255                SLO   XX2            T-VALUE        0381  16 0022 0377
256                STL   XXD            AT THAT        0377  20 0431 0284
257    1                                PERCENTAGE
258                RAU   XX1                           0284  60 0076 0481
259                SUP   DLPM                          0481  11 0561 0265
260                SRT    0004                         0265  30 0004 0125
261                DVR   XXD                           0125  64 0431 0141
262                STL   XXDD                          0141  20 0145 0048
263    1
264                RAU   YY2                           0048  60 0100 0405
265                SUP   YY1                           0405  11 0254 0409
266                MPY   XXDD                          0409  19 0145 0315
267                SRD    0006                         0315  31 0006 0531
268                ALO   YY1    ZHH                   0531  15 0254 0099
269          ZHH   STL   TT                            0099  20 0103 0106
270    1
271                RAL   DLPC                          0106  65 0046 0101
272                BMI   NGDL     PSDL                 0101  46 0304 0455
273    1
274          NGDL  RSL   TT       TTOUT                0304  66 0103 0407
275          PSDL  RAL   TT       TTOUT                0455  65 0103 0407
276          TTOUT STL   C0003    CDDD                 0407  20 1602 0505
277          CDDD  STL   P0007                          0505  20 0033 0336
278    1
279                PCH   P0001            PUNCH CARD     0336  71 0027 0427
280    1
281                RAL   CRDCT            STEP CARD      0427  65 0186 0191
282                ALO   ONEEE            COUNT BY       0191  15 0130 0435
283                STL   CRDCT            ONE            0435  20 0186 0189
284    1
285                RAL   AA111            STEP DATA      0189  65 0143 0147
286                ALO   INCDA            ADDRESS OF     0147  15 0250 0555
```

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                        STL     AA111                   AA111 AND       0555  20 0143 0196
1                                                       AA222 AND
                        RAL     AA222                   TTOUT           0196  65 0115 0069
                        ALO     INCDA                                   0069  15 0250 0605
                        STL     AA222                                   0605  20 0115 0068
1
                        RAL     TTOUT                                   0068  65 0407 0661
                        ALO     INCDA                                   0661  15 0250 0655
                        STL     TTOUT   DATA2                           0655  20 0407 0089
1
1                         END OF SAMPLE, SO BEGIN CALCS
1
        LAST    RAL     E0001                   MOVE DEPTH      0185  65 1671 0175
                SLT      0005                                   0175  35 0005 0237
                STL     P0005                                   0237  20 0031 0334
1
                RAL     SUMMP                   IS SUM          0334  65 0111 0365
                SLO     PC100                   PERCENT         0365  16 0018 0273
                RAM     LOWER                   WITHIN          0273  67 8002 0581
                SLO     SEVEN                   0.06  OF        0581  16 0384 0239
                BMI     YESP                    100.00          0239  46 0042 0243
1
                RAL     SUMMP                   NO, SO          0243  65 0111 0415
                STL     P0006                   PUNCH           0415  20 0032 0485
1                                               ERROR
1                                               CARD
1
                STD     P0007                                   0485  24 0033 0386
                STD     P0008                                   0386  24 0034 0287
                STD     P0009                                   0287  24 0035 0238
1
                PCH     P0001   INITL   PUNCH CARD              0238  71 0027 0011
1
        YESP    RAL     CRDCT                   YES, SO         0042  65 0186 0241
                SLO     FOURR                   ARE THERE       0241  16 0094 0249
                BMI             YESC            MORE THAN       0249  46 0052 0203
1                                               FOUR SIZES
1                                               CLASSES
1
                RAL     P0005                   NO, SO          0052  65 0031 0535
                ALO     CRDCT                   PUNCH           0535  15 0186 0291
                STL     P0005                   ERROR           0291  20 0031 0434
1                                               CARD
                LDD     SUMMP                                   0434  69 0111 0114
                STD     P0006   NOO                             0114  24 0032 0300
1
        YESC    RAL     AA111                    YES, SO        0203  65 0143 0197
                LDD     A41                     REMOVE          0197  69 0350 0253
                SDA     A41                     LAST PHI        0253  22 0350 0303
                LDD     TSTAA   A41             AND             0303  69 0156 0350
        A41     STD     A0001                   PERCENT         0350  24 1500 0353
1                                               FROM A
                RAL     AA222                   AND B           0353  65 0115 0119
                LDD     A42                     REGIONS         0119  69 0072 0225
                SDA     A42                                     0225  22 0072 0275
                LDD     TSTAA   A42                             0275  69 0156 0072
        A42     STD     B0001   IN5                             0072  24 1550 0403
1
        IN5     LDD     0T5                     PREPARE TO      0403  69 0206 0459
                STD     OUT                      INTRPOLAT      0459  24 0012 0465
                LDD     PC005                    PHI 5          0465  69 0118 0271
                STD     XX                                      0271  24 0600 0453
                LDD     TT005                                   0453  69 0256 0509
                STD     XT                                      0509  24 0062 0515
                LDD     IA                                      0515  69 0168 0321
                STD     AAA                                     0321  24 0174 0527
                LDD     2A                                      0527  69 0280 0433
                STD     BBB     ENTR                            0433  24 0436 0289
1
        0T5     STL     PH10S                                   0206  20 0711 0164
                RAL     TEST1                                   0164  65 0167 0371
                ALO     BD001                                   0371  15 0224 0329
                STL     TEST1   IN16                            0329  20 0167 0020
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360   1
361   1
362          IN16    LDD   0T16              PREPARE TO      0020  69 0323 0126
363                  STD   OUT                 INTRPOLAT     0126  24 0012 0565
364                  LDD   PC016               PHI 16        0565  69 0218 0421
365                  STD   XX                                0421  24 0600 0503
366                  LDD   TT016                             0503  69 0306 0559
367                  STD   XT                                0559  24 0062 0615
368                  LDD   IB                                0615  69 0268 0471
369                  STD   AAA                               0471  24 0174 0577
370                  LDD   2B                                0577  69 0330 0483
371                  STD   BBB     ENTR                      0483  24 0436 0289
372   1
373          0T16    STL   PHI16                             0323  20 0627 0380
374                  RAL   TEST1                             0380  65 0167 0521
375                  ALO   BD002                             0521  15 0274 0379
376                  STL   TEST1   IN25                      0379  20 0167 0070
377   1
378          IN25    LDD   0T25              PREPARE TO      0070  69 0373 0176
379                  STD   OUT                 INTRPOLAT     0176  24 0012 0665
380                  LDD   PC025               PHI 25        0665  69 0318 0571
381                  STD   XX                                0571  24 0600 0553
382                  LDD   TT025                             0553  69 0356 0609
383                  STD   XT                                0609  24 0062 0715
384                  LDD   IC                                0715  69 0368 0621
385                  STD   AAA                               0621  24 0174 0677
386                  LDD   2C                                0677  69 0430 0533
387                  STD   BBB     ENTR                      0533  24 0436 0289
388   1
389          0T25    STL   PHI25                             0373  20 0727 0480
390                  RAL   TEST1                             0480  65 0167 0671
391                  ALO   BD003                             0671  15 0324 0429
392                  STL   TEST1   IN50                      0429  20 0167 0120
393   1
394          IN50    LDD   0T50              PREPARE TO      0120  69 0423 0226
395                  STD   OUT                 INTRPOLAT     0226  24 0012 0765
396                  LDD   PC050               PHI 50        0765  69 0286 0339
397                  STD   XX                                0339  24 0600 0603
398                  LDD   TT050                             0603  69 0406 0659
399                  STD   XT                                0659  24 0062 0815
400                  LDD   ID                                0815  69 0418 0721
401                  STD   AAA                               0721  24 0174 0777
402                  LDD   2D                                0777  69 0630 0583
403                  STD   BBB     ENTR                      0583  24 0436 0289
404   1
405          0T50    STL   PHI50                             0423  20 0827 0680
406                  RAL   TEST1                             0680  65 0167 0771
407                  ALO   BD004                             0771  15 0374 0479
408                  STL   TEST1   IN75                      0479  20 0167 0170
409   1
410          IN75    LDD   0T75              PREPARE TO      0170  69 0473 0276
411                  STD   OUT                 INTRPOLAT     0276  24 0012 0865
412                  LDD   PC075               PHI 75        0865  69 0468 0821
413                  STD   XX                                0821  24 0600 0653
414                  LDD   TT075                             0653  69 0456 0709
415                  STD   XT                                0709  24 0062 0915
416                  LDD   ID                                0915  69 0418 0871
417                  STD   AAA                               0871  24 0174 0877
418                  LDD   4D                                0877  69 0730 0633
419                  STD   BBB     ENTR                      0633  24 0436 0289
420   1
421          0T75    STL   PHI75                             0473  20 0927 0780
422                  RAL   TEST1                             0780  65 0167 0921
423                  ALO   BD005                             0921  15 0424 0529
424                  STL   TEST1   IN84                      0529  20 0167 0220
425   1
426          IN84    LDD   0T84              PREPARE TO      0220  69 0523 0326
427                  STD   OUT                 INTRPOLAT     0326  24 0012 0965
428                  LDD   PC084               PHI 84        0965  69 0518 0971
429                  STD   XX                                0971  24 0600 0703
430                  LDD   TT084                             0703  69 0506 0759
431                  STD   XT                                0759  24 0062 1015
432                  LDD   IE                                1015  69 0568 1021
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433                 STD   AAA                          1021  24 0174 0977
434                 LDD   2E                           0977  69 0830 0683
435                 STD   BBB     ENTR                 0683  24 0436 0289
436   1
437         OT84    STL   PHI84                        0523  20 1027 0880
438                 RAL   TEST1                        0880  65 0167 1071
439                 ALO   BD006                        1071  15 0474 0579
440                 STL   TEST1   IN95                 0579  20 0167 0270
441   1
442         IN95    LDD   OT95                         0270  69 0573 0376
443                 STD   OUT                          0376  24 0012 1065
444                 LDD   PC095                        1065  69 0618 1121
445                 STD   XX                           1121  24 0600 0753
446                 LDD   TT095                        0753  69 0556 0809
447                 STD   XT                           0809  24 0062 1115
448                 LDD   IE                           1115  69 0568 1171
449                 STD   AAA                          1171  24 0174 1077
450                 LDD   4E                           1077  69 0930 0733
451                 STD   BBB     ENTR                 0733  24 0436 0289
452   1
453         OT95    STL   PHI95                        0573  20 1127 0980
454                 RAL   TEST1                        0980  65 0167 1221
455                 ALO   BD007                        1221  15 0524 0629
456                 STL   TEST1   TEST2                0629  20 0167 0320
457   1
458         ENTR    RAL   ZEROS                        0289  65 0087 0341
459                 LDD   XX                           0341  69 0600 0803
460                 TLU   B0001                        0803  84 1550 0705
461                 STL   TPSTT                        0705  20 0859 0112
462                 STD   TPST                         0112  24 1165 0668
463   1
464                 RAL   SUML1                        0668  65 1271 0325
465                 SLO   XX                           0325  16 0600 0755
466                 BMI   MAX                          0755  46 0258 0909
467   1
468                 RAL   TPSTT                        0909  65 0859 0113
469                 LDD   T1                           0113  69 0066 0169
470                 SDA   T1      DISTB                0169  22 0066 8001
471         T1      RAL   B0001                        0066  65 1550 0805
472                 SLO   XX                           0805  16 0600 0855
473                 NZE   CMPT                         0855  45 0308 0959
474   1
475                 RAL   TPSTT                        0959  65 0859 0163
476                 SLO   DA050                        0163  16 0116 1321
477                 LDD   T2                           1321  69 0574 1177
478                 SDA   T2      DISTB                1177  22 0574 8001
479         T2      RAL   B0001                        0574  65 1550 0905
480                 SLO   PHI10   OUT                  0905  16 0038 0012
481   1
482         CMPT    RAL   TPSTT                        0308  65 0859 0213
483                 ALO   INCDA                        0213  15 0250 0955
484                 LDD   T21                          0955  69 0358 0761
485                 SDA   T21     DISTB                0761  22 0358 8001
486         T21     RAL   B0001                        0358  65 1550 1005
487                 SLO   TSTAA                        1005  16 0156 0811
488                 NZE   NO1     YES1                 0811  45 0214 1215
489   1
490         NO1     RAL   TPSTT                        0214  65 0859 0263
491                 SLO   DA002                        0263  16 0132 0337
492                 LDD   T23                          0337  69 0040 0293
493                 SDA   T23     DISTB                0293  22 0040 8001
494         T23     RAL   B0001                        0040  65 1550 1055
495                 NZE   STOR    YES2                 1055  45 0408 1009
496   1
497         YES1    RAL   TPSTT                        1215  65 0859 0313
498                 SLO   INCDA                        0313  16 0250 1105
499                 STL   TPSTT                        1105  20 0859 0162
500                 LDD   ATESS                        0162  69 0153 0606
501                 STD   TEST6   STOR                 0606  24 1059 0408
502   1
503         YES2    RAL   TPSTT                        1009  65 0859 0363
504                 SLO   DA002                        0363  16 0132 0387
505                 SLO   DA551                        0387  16 0090 0195
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506                BMI   N02     STOR    LARGER      0195  46 0098 0408
507  1
508          N02   RAL   TPSTT           ADD ONE     0098  65 0859 0413
509                ALO   INCDA            TO TPSTT   0413  15 0250 1155
510                STL   TPSTT                        1155  20 0859 0212
511                LDD   ATESS                        0212  69 0153 0656
512                STD   TEST6   STOR                 0656  24 1059 0408
513  1
514          MAX   RAL   TPSTT                        0258  65 0859 0463
515                SLO   DA002                        0463  16 0132 0437
516                STL   TPSTT                        0437  20 0859 0262
517  1
518                LDD   TEST1           FIND HIEST   0262  69 0167 0370
519                BD1   NOP              VALUE OF    0370  91 0623 0375
520                BD2   NOP              ACCUMULTD   0375  92 0623 1030
521                BD3   NOP              PERCENT     1030  93 0623 0585
522                BD4   NOP              WHICH CAN   0585  94 0623 0190
523                BD5   EX75            BE           0190  95 0343 0245
524                BD6   EX84             EXTRAPLTD   0245  96 0148 0400
525                BD7   EX95    NOP                  0400  97 0853 0623
526  1
527          EX75  RAL   SUML1           CAN PHI-75   0343  65 1271 0425
528                SLO   PC072            BE          0425  16 0178 0783
529                BMI   NOP              EXTRAPLTD   0783  46 0623 0487
530  1
531                LDD   TT075           YES, SO      0487  69 0456 1109
532                STD   XT               SET EXTP    1109  24 0062 1265
533                RSL   P0005            CODE        1265  66 0031 0635
534                SLO   ONEEE                        0635  16 0130 0685
535                STL   P0005                        0685  20 0031 0484
536  1
537                RAL   TEST3           SET TEST 3   0484  65 0537 0391
538                ALO   BD003           SO AS NOT    0391  15 0324 0679
539                ALO   BD002           TO CALC FW   0679  15 0274 0729
540                STL   TEST3            OR INMAN    0729  20 0537 0240
541  1                                    VALUES
542                LDD   OT75X                        0240  69 0393 0246
543                STD   OUT     STOR                 0246  24 0012 0408
544  1
545          OT75X STL   PHI75   TEST2                0393  20 0927 0320
546  1
547          EX84  RAL   SUML1           CAN PHI-84   0148  65 1271 0475
548                SLO   PC081            BE EXTPLD   0475  16 0228 0833
549                BMI   NOPA                         0833  46 0486 0587
550  1
551                LDD   TT084           YES, SO      0587  69 0506 1159
552                STD   XT               SET         1159  24 0062 1315
553                RSL   P0005            EXTP CODE   1315  66 0031 0735
554                SLO   TW000                        0735  16 0024 0779
555                STL   P0005                        0779  20 0031 0534
556  1
557                RAL   TEST3           SET TEST 3   0534  65 0537 0441
558                ALO   BD003            SO DO NOT   0441  15 0324 0829
559                STL   TEST3            CALCULATE   0829  20 0537 0290
560  1                                    FOLK AND
561                LDD   ATESS            WARD        0290  69 0153 0706
562                STD   TEST6            VALUES      0706  24 1059 0312
563                LDD   OT84X                        0312  69 1365 0718
564                STD   OUT     STOR                 0718  24 0012 0408
565  1
566  1
567          OT84X STL   PHI84   TEST2                1365  20 1027 0320
568  1
569          EX95  RAL   SUML1           CAN PHI-95   0853  65 1271 0525
570                SLO   PC092            BE          0525  16 0278 0883
571                BMI   NOPB             EXTRAPLTD   0883  46 0536 0637
572  1
573                LDD   TT095           YES, SO      0637  69 0556 1209
574                STD   XT               SET EXTP    1209  24 0062 0166
575                RSL   P0005            CODE        0166  66 0031 0785
576                SLO   THREE                        0785  16 0288 0443
577                STL   P0005                        0443  20 0031 0584
578  1
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579                 LDD   ATESS                                  0584  69 0153 0756
580                 STD   TEST6                                  0756  24 1059 0362
581   1
582                 LDD   OT95X                                  0362  69 0216 0219
583                 STD   OUT     STOR                           0219  24 0012 0408
584   1
585         OT95X   STL   PHI95   TEST2                          0216  20 1127 0320
586   1
587         NOP     RAL   TEST3             NO VALUES            0623  65 0537 0491
588                 ALO   BD003               CAN BE             0491  15 0324 0879
589                 ALO   BD002               CALCULATD          0879  15 0274 0929
590                 ALO   BD001                                  0929  15 0224 0979
591                 STL   TEST3   TEST2                          0979  20 0537 0320
592   1
593         NOPA    RAL   TEST3             PHI-75               0486  65 0537 0541
594                 ALO   BD003               CALCD BUT          0541  15 0324 1029
595                 ALO   BD002               PHI-84             1029  15 0274 1079
596                 STL   TEST3   TEST2        CANT BE           1079  20 0537 0320
597   1
598         NOPB    RAL   TEST3             PHI-84               0536  65 0537 0591
599                 ALO   BD003               CALCD BUT          0591  15 0324 1129
600                 STL   TEST3   TEST2        PHI-95            1129  20 0537 0320
601   1                                       CANT BE
602   1
603   1
604   1               THE INTERPOLATION METHOD OF
605   1               AITKENS SUCCESSIVE ITERATIONS
606   1               USING FOUR POINTS
607   1
608   1               X VALUES ARE T-VALUES
609   1                  AND
610   1               Y VALUES ARE PHI SIZES
611   1
612         STOR    RAL   TPSTT             LOAD                 0408  65 0859 0513
613                 SLO   DA002               T-VALUES           0513  16 0132 0687
614                 ALO   DA050               INTO X             0687  15 0116 1371
615                 LDD   INX                 CELLS AND          1371  69 0624 1227
616                 SDA   INX                 PHI                1227  22 0624 1277
617                 SLO   DA100               VALUES             1277  16 1080 0835
618                 LDD   INY                 INTO Y             0835  69 0338 0641
619                 SDA   INY     INX         CELLS              0641  22 0338 0624
620         INX     LDD   C0001   M0001                          0624  69 1600 1681
621         M0001   STD   X1      INY                          1681  24 0550 0338
622         INY     LDD   A0001   M0002                          0338  69 1500 1682
623         M0002   STD   Y1      M0003                          1682  24 0500 1683
624         M0003   RAL   TEST4                                  1683  65 0586 0691
625                 SLO   ONEEE                                  0691  16 0130 0885
626                 STL   TEST4                                  0885  20 0586 0389
627                 NZE           COMNS                          0389  45 0092 0493
628   1
629                 RAL   INX               STEP DATA            0092  65 0624 1179
630                 ALO   INCDA               ADDRESSES          1179  15 0250 1205
631                 STL   INX                 INX THRU           1205  20 0624 1327
632                 RAL   M0001               M0002 BY           1327  65 1681 0935
633                 ALO   DA010               TEN                0935  15 0388 0543
634                 STL   M0001                                  0543  20 1681 0634
635                 RAL   INY                                    0634  65 0338 0593
636                 ALO   INCDA                                  0593  15 0250 1255
637                 STL   INY                                    1255  20 0338 0741
638                 RAL   M0002                                  0741  65 1682 0737
639                 ALO   DA010                                  0737  15 0388 0643
640                 STL   M0002   INX                            0643  20 1682 0624
641   1
642         COMNS   LDD   ORGM1               RESTORE            0493  69 0296 0299
643                 STD   M0001               M0001 AND          0299  24 1681 0684
644                 LDD   ORGM2               M0002              0684  69 0787 0340
645                 STD   M0002               BEFORE             0340  24 1682 0985
646                 LDD   FOURR               INTRPOLATN         0985  69 0094 0247
647                 STD   TEST4                                  0247  24 0586 0439
648                 LDD   XT                                     0439  69 0062 0266
649                 STD   XX      AIKNS                          0266  24 0600 0903
650   1
651   1
```

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652          AIKNS   RAU   X2                    AITKENS          0903  60 0560 0316
653                  SUP   X1                     METHOD          0316  11 0550 1305
654                  SRT    0004                  FIRST           1305  30 0004 0366
655                  STL   X21                     ITERATION       0366  20 0122 0575
656                  NZE                 ST                       0575  45 0328 1229
657     1
658                  RAU   X1                                      0328  60 0550 1355
659                  SUP   XX                                      1355  11 0600 0806
660                  STU   X1X                                     0806  21 0160 0563
661                  MPY   Y2                                      0563  19 0510 0631
662                  STL   X1Y2                                    0631  20 1035 0438
663     1
664                  RAU   X2                                      0438  60 0560 0416
665                  SUP   XX                                      0416  11 0600 0856
666                  STU   X2X                                     0856  21 0210 0613
667                  MPY   Y1                                      0613  19 0500 0172
668                  SLO   X1Y2                                    0172  16 1035 0489
669     1
670                  RAU   LOWER                                   0489  60 8002 0297
671                  DVR   X21                                     0297  64 0122 0933
672                  STL   I12                                     0933  20 0837 0390
673     1
674     1
675                  RAU   X3                    SECOND           0390  60 0570 0625
676                  SUP   X1                      ITERATION       0625  11 0550 0906
677                  SRT    0004                                   0906  30 0004 0217
678                  STL   X31                                     0217  20 0222 0675
679                  NZE                 ST                       0675  45 0378 1229
680     1
681                  RAU   X1X                                     0378  60 0160 0466
682                  MPY   Y3                                      0466  19 0520 0791
683                  STL   X1Y3                                    0791  20 0295 0198
684     1
685                  RAU   X3                                      0198  60 0570 0725
686                  SUP   XX                                      0725  11 0600 0956
687                  STU   X3X                                     0956  21 0260 0663
688                  MPY   Y1                                      0663  19 0500 0272
689                  SLO   X1Y3                                    0272  16 0295 0349
690     1
691                  RAU   LOWER                                   0349  60 8002 0457
692                  DVR   X31                                     0457  64 0222 0983
693                  STL   I13                                     0983  20 0887 0440
694     1
695     1
696                  RAU   X4                    THIRD            0440  60 0580 1085
697                  SUP   X1                      ITERATION       1085  11 0550 1006
698                  SRT    0004                                   1006  30 0004 0267
699                  STL   X41                                     0267  20 0322 0775
700                  NZE                 ST                       0775  45 0428 1229
701     1
702                  RAU   X1X                                     0428  60 0160 0516
703                  MPY   Y4                                      0516  19 0530 0151
704                  STL   X1Y4                                    0151  20 1056 1259
705     1
706                  RAU   X4                                      1259  60 0580 1135
707                  SUP   XX                                      1135  11 0600 1106
708                  STU   X4X                                     1106  21 0310 0713
709                  MPY   Y1                                      0713  19 0500 0372
710                  SLO   X1Y4                                    0372  16 1056 0861
711     1
712                  RAU   LOWER                                   0861  60 8002 0269
713                  DVR   X41                                     0269  64 0322 1033
714                  STL   I14                                     1033  20 0937 0490
715     1
716     1
717                  RAU   X3                    FOURTH           0490  60 0570 0825
718                  SUP   X2                      ITERATION       0825  11 0560 0566
719                  SRT    0004                                   0566  30 0004 1377
720                  STL   X32                                     1377  20 0681 0734
721                  NZE                 ST                       0734  45 0488 1229
722                  RAU   X2X                                     0488  60 0210 0616
723                  MPY   I13                                     0616  19 0887 0507
724                  SRD    0003                                   0507  31 0003 0317
```

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725                 STL   X21A                          0317 20 0422 0875
726  1
727                 RAU   X3X                          0875 60 0260 0666
728                 MPY   I12                          0666 19 0837 0557
729                 SRD    0003                        0557 31 0003 0367
730                 SLO   X21A                         0367 16 0422 0478
731  1
732                 RAU   LOWER                        0478 60 8002 0987
733                 DVR   X32                          0987 64 0681 0841
734                 STL   I123                         0841 20 0345 0248
735  1
736  1
737                 RAU   X4              FIFTH        0248 60 0580 1185
738                 SUP   X2                ITERATION  1185 11 0560 0716
739                 SRT    0004                        0716 30 0004 0528
740                 STL   X42                          0528 20 1083 0636
741                 NZE               ST               0636 45 0540 1229
742                 RAU   X2X                          0540 60 0210 0766
743                 MPY   I14                          0766 19 0937 0607
744                 SRD    0003                        0607 31 0003 0417
745                 STL   X21B                         0417 20 0472 0925
746  1
747                 RAU   X4X                          0925 60 0310 0816
748                 MPY   I12                          0816 19 0837 0657
749                 SRD    0003                        0657 31 0003 0467
750                 SLO   X21B                         0467 16 0472 0578
751  1
752                 RAU   LOWER                        0578 60 8002 1037
753                 DVR   X42                          1037 64 1083 0693
754                 STL   I124                         0693 20 0347 0450
755  1
756  1
757                 RAU   X4              SIXTH AND    0450 60 0580 1235
758                 SUP   X3                FINAL      1235 11 0570 0975
759                 SRT    0004             ITERATION  0975 30 0004 1285
760                 STL   X43                          1285 20 0539 0142
761                 NZE               ST               0142 45 0346 1229
762                 RAU   X3X                          0346 60 0260 0866
763                 MPY   I124                         0866 19 0347 0517
764                 SRD    0003                        0517 31 0003 0628
765                 STL   X31C                         0628 20 1133 0686
766  1
767                 RAU   X4X                          0686 60 0310 0916
768                 MPY   I123                         0916 19 0345 0966
769                 SRD    0003                        0966 31 0003 0678
770                 SLO   X31C                         0678 16 1133 1087
771  1
772                 SLT    0008                        1087 35 0008 1156
773                 DVR   X43                          1156 64 0539 0399
774                 SRD    0004                        0399 31 0004 0911
775                 SLO   PHI10                        0911 16 0038 0743
776                 STL   PHIAK       ST               0743 20 0397 1229
777  1
778           ST    RAL   TEST6           DO XS + YS   1229 65 1059 0763
779                 NZE   YESI    NOI     NEED TO BE   0763 45 1016 0567
780  1                                      CHANGED
781  1
782           YESI  RAL   TPST            BEFORE       1016 65 1165 0319
783                 ALO   DA050             LINEAR     0319 15 0116 0522
784                 LDD   LIA               INTERP     0522 69 1025 0728
785                 SDA   LIA       DISTB              0728 22 1025 8001
786           LIA   LDD   B0001     AA                 1025 69 1550 0150
787           AA    STD   X3                          0150 24 0570 0673
788                 SLO   DA100                       0673 16 1080 1335
789                 LDD   LIB                         1335 69 0538 0891
790                 SDA   LIB       DISTB              0891 22 0538 8001
791           LIB   LDD   A0001     BA                 0538 69 1500 0140
792           BA    STD   Y3                          0140 24 0520 0723
793                 RAL   LIA                         0723 65 1025 1279
794                 SLO   DI104     LOWER              1279 16 0182 8002
795           AAB   STD   X2                          0146 24 0560 0813
796                 RAL   LIB                         0813 65 0538 0793
797                 SLO   DI104     LOWER              0793 16 0182 8002
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798          BAB     STD     Y2        NOI                        0136  24 0510 0567
799    1
800          NOI     RAU     X3                  LINEAR           0567  60 0570 1075
801                  SUP     X2                    INTERPLAT      1075  11 0560 1066
802                  STU     E0002                                1066  21 1672 1125
803    1
804                  RAU     XX                                   1125  60 0600 1206
805                  SUP     X2                                   1206  11 0560 1116
806                  SRT      0004                                1116  30 0004 0778
807                  DVR     E0002                                0778  64 1672 1183
808                  STL     E0003                                1183  20 1673 0426
809    1
810                  RAU     Y3                                   0426  60 0520 1175
811                  SUP     Y2                                   1175  11 0510 1166
812                  MPY     E0003                                1166  19 1673 0843
813                  SRD      0006                                0843  31 0006 1309
814                  ALO     Y2                                   1309  15 0510 1216
815                  SLO     PHI10                                1216  16 0038 0893
816                  STL     PHILN                                0893  20 0447 0650
817    1
818                  SLO     PHIAK               IS PHI BY        0650  16 0397 0201
819                  RAM     LOWER                 AITKENS        0201  67 8002 1359
820                  SLO     TWNTY                 CLOSE TO       1359  16 0412 0617
821                  BMI     YESJ      NOJ         LINEAR INT     0617  46 0420 0572
822    1
823          YESJ    RAL     TPSTT               IS CALCD         0420  65 0859 0863
824                  SLO     DA050                 PHI LARGR      0863  16 0116 0622
825                  LDD     TA                    THAN PHI       0622  69 1225 0828
826                  SDA     TA        DISTB       AT TPSTT       0828  22 1225 8001
827          TA      RAL     A0001     L117                       1225  65 1500 0117
828          L117    SLO     PHI10                                0117  16 0038 0993
829                  BMI     NOJ                                  0993  46 0572 0497
830    1
831    1
832                  RAL     TA                    AND LESS       0497  65 1225 1329
833                  SLO     CDATT     LOWER       THAN PHI       1329  16 0232 8002
834          L096    SLO     PHIAK                 AT TPSTT       0096  16 0397 0251
835                  SLO     PHI10                 LESS ONE       0251  16 0038 1043
836                  BMI               NOJ                        1043  46 0396 0572
837    1
838                  RAL     TEST7               AITKENS          0396  65 0449 0953
839                  ALO     AAA                   VALUE          0953  15 0174 1379
840                  STL     TEST7                 GOOD           1379  20 0449 0102
841                  LDD     ZEROS                                0102  69 0087 0590
842                  STD     TEST6                                0590  24 1059 0462
843                  RAL     PHIAK     OUT                        0462  65 0397 0012
844    1
845          NOJ     RAL     TEST7               LINEAR           0572  65 0449 1003
846                  ALO     BBB                   VALUE          1003  15 0436 0941
847                  STL     TEST7                 BETTER         0941  20 0449 0152
848                  LDD     ZEROS                                0152  69 0087 0640
849                  STD     TEST6                                0640  24 1059 0512
850                  RAL     PHILN     OUT                        0512  65 0447 0012
851    1
852          PCHFI   RAM     PHI05               PREPARE TO       0700  67 0711 1266
853                  SLT      0005                 PUNCH PHI      1266  35 0005 1130
854                  AML     PHI16                 VALUES         1130  17 0627 0731
855                  STL     P0006                                0731  20 0032 1385
856    1
857                  RAM     PHI25                                1385  67 0727 0781
858                  SLT      0005                                0781  35 0005 1093
859                  AML     PHI50                                1093  17 0827 0831
860                  STL     P0007                                0831  20 0033 0736
861    1
862                  RAM     PHI75                                0736  67 0927 0881
863                  SLT      0005                                0881  35 0005 1143
864                  AML     PHI84                                1143  17 1027 0931
865                  STL     P0008                                0931  20 0034 1137
866    1
867                  RAM     PHI95                                1137  67 1127 0981
868                  SLT      0005                                0981  35 0005 1193
869                  ALO     TEST7                                1193  15 0449 1053
870                  STL     P0009                                1053  20 0035 0588
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871   1
872                LDD   CW010                                0588  69 0991 0144
873                STD   P0010                                0144  24 0036 0589
874   1
875                RAL   PH105          TEST FOR              0589  65 0711 1316
876                BM1                  NEGATIVE              1316  46 0369 0470
877                RAL   CW001          VALUES                0369  65 0672 0878
878                ALO   P0010                                0878  15 0036 1041
879                STL   P0010    TS16                        1041  20 0036 0470
880   1
881          TS16  RAL   PH116                                0470  65 0627 1031
882                BM1                  TS25                  1031  46 0784 0786
883                RSL   P0006                                0784  66 0032 1187
884                STL   P0006    TS25                        1187  20 0032 0786
885   1
886          TS25  RAL   PH125                                0786  65 0727 1081
887                BM1                  TS50                  1081  46 0834 0836
888                RAL   CW002                                0834  65 1237 1091
889                ALO   P0010                                1091  15 0036 1141
890                STL   P0010    TS50                        1141  20 0036 0836
891   1
892          TS50  RAL   PH150                                0836  65 0827 1131
893                BM1                  TS75                  1131  46 0884 0886
894                RSL   P0007                                0884  66 0033 1287
895                STL   P0007                                1287  20 0033 0936
896                LDD   CW001                                0936  69 0672 1275
897                STD   P1CW     TS75                        1275  24 0928 0886
898   1
899          TS75  RAL   PH175                                0886  65 0927 1181
900                BM1                  TS84                  1181  46 0934 0986
901                RAL   CW003                                0934  65 1337 1191
902                ALO   P0010                                1191  15 0036 1241
903                STL   P0010    TS84                        1241  20 0036 0986
904   1
905          TS84  RAL   PH184                                0986  65 1027 1231
906                BM1                  TS95                  1231  46 0984 1036
907                RSL   P0008                                0984  66 0034 0639
908                STL   P0008    TS95                        0639  20 0034 1036
909   1
910          TS95  RAL   PH195                                1036  65 1127 1281
911                BM1                  PCHF                  1281  46 1034 1086
912                RAL   CW004                                1034  65 1387 1291
913                ALO   P0010                                1291  15 0036 1341
914                STL   P0010    PCHF                        1341  20 0036 1086
915   1
916          PCHF  RAL   P0004          SET CARD              1086  65 0030 1136
917                SRT    0001          TYPE                  1136  30 0001 1243
918                SLT    0001          NO.  3                1243  35 0001 0499
919                ALO   THREE                                0499  15 0288 1293
920                STL   P0004                                1293  20 0030 1233
921   1
922                PCH   P0001          PUNCH PH1             1233  71 0027 0978
923   1                                 VALUES
924   1
925          1A    00     0001   0000   CONSTANT              0168  00 0001 0000
926          18    00     0000   1000   CONSTANT              0268  00 0000 1000
927          1C    00     0000   0100   CONSTANT              0368  00 0000 0100
928          1D    00     0000   0010   CONSTANT              0418  00 0000 0010
929          1E    00     0000   0001   CONSTANT              0568  00 0000 0001
930   1
931          2A    00     0002   0000   CONSTANT              0280  00 0002 0000
932          28    00     0000   2000   CONSTANT              0330  00 0000 2000
933          2C    00     0000   0200   CONSTANT              0430  00 0000 0200
934          2D    00     0000   0020   CONSTANT              0630  00 0000 0020
935          2E    00     0000   0002   CONSTANT              0830  00 0000 0002
936   1
937          4D    00     0000   0040   CONSTANT              0730  00 0000 0040
938          4E    00     0000   0004   CONSTANT              0930  00 0000 0004
939   1
940          ORGA1 STU    A0003  AA11   CONSTANT              0750  21 1502 0155
941          ORGA2 STU    B0003  A22    CONSTANT              0800  21 1552 0205
942          ORGOT STL    C0003  CDDD   CONSTANT              0850  20 1602 0505
943          ORGM1 STD    X1     1NY    CONSTANT              0296  24 0550 0338
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 944         ORGM2   STD   Y1      M0003   CONSTANT      0787 24 0500 1683
 945   1
 946         ZD      RAL   T0001   ZC      CONSTANT      0230 65 1400 0355
 947   1
 948   1
 949                 PST
 950                 CLH
 951                 RAL   TEST3           INDICATE      0978 65 0537 1391
 952                 ALO   BD005           PHI VALUS     1391 15 0424 1180
 953                 STL   TEST3   CC2     COMPLETED     1180 20 0537 0690
 954   1
 955         TEST2   LDD   TEST3   CC2     DECIDE        0320 69 0537 0690
 956         CC2     BD5   PCHFI           WHICH         0690 95 0700 0395
 957                 BD4   SSCLY           RESULTS       0395 94 0298 0900
 958                 BD1   TRASK           ARE TO BE     0900 91 1103 1256
 959                 BD2   INMAN           COMPUTED      1256 92 0360 0961
 960                 BD3   FANDW   INITL                 0961 93 0264 0011
 961   1
 962   1               CALCULATE SAND SILT CLAY
 963   1               RELATIONSHIPS
 964   1
 965         SSCLY   RAL   ZEROS           FIND PRCT     0298 65 0087 0192
 966                 LDD   PHI4            SAND BY       0192 69 0445 0348
 967                 TLU   A0001           USING TLU     0348 84 1500 1306
 968                 ALO   DA050                         1306 15 0116 0722
 969                 LDD   H1                            0722 69 1325 1028
 970                 SDA   H1      DISTB                 1028 22 1325 8001
 971         H1      RSL   BX                            1325 66 1078 1283
 972                 STD   SAND                          1283 24 1186 0689
 973                 ALO   SUMMP                         0689 15 0111 1366
 974                 STL   SHALE                         1366 20 0772 1375
 975   1
 976                 RAL   PHIB            IS PHIB       1375 65 1128 1333
 977                 SLO   PHI8            LARGER        1333 16 1236 0242
 978                 BMI   N09     YES9    THAN  8       0242 46 0495 0446
 979         N09     RAL   SUMMP                         0495 65 0111 0667
 980                 SLO   SAND                          0667 16 1186 0292
 981                 STL   SILT                          0292 20 0547 0950
 982                 LDD   ZEROS                         0950 69 0087 0740
 983                 STD   CLAY    NXS                   0740 24 1343 0496
 984   1
 985         YES9    RAL   ZEROS           FIND PRCT     0446 65 0087 0342
 986                 LDD   PHI8            SILT BY       0342 69 1236 0739
 987                 TLU   A0001           USING TLU     0739 84 1500 1356
 988                 ALO   DA050                         1356 15 0116 0822
 989                 LDD   H2                            0822 69 0476 1230
 990                 SDA   H2      DISTB                 1230 22 0476 8001
 991         H2      RAL   BX                            0476 65 1078 1383
 992                 SLO   SAND                          1383 16 1186 0392
 993                 STL   SILT                          0392 20 0547 1000
 994   1
 995                 RAL   SUMMP           CALC PRCT     1000 65 0111 0717
 996                 SLO   SAND            CLAY          0717 16 1186 0442
 997                 SLO   SILT                          0442 16 0547 0301
 998                 STL   CLAY    NXS                   0301 20 1343 0496
 999   1
1000         NXS     RAL   ZEROS           CALC PRCT     0496 65 0087 0492
1001                 LDD   PHI-1           FRACTION      0492 69 0545 0398
1002                 TLU   A0001           OF SAMPLE     0398 84 1500 0707
1003                 ALO   DA050           LARGER        0707 15 0116 0872
1004                 LDD   H3              THAN SAND     0872 69 0526 1280
1005                 SDA   H3      DISTB                 1280 22 0526 8001
1006         H3      LDD   BX                            0526 69 1078 1331
1007                 STD   LRGSN                         1331 24 1084 0638
1008                 RAL   SAND            CALC TRUE     0638 65 1186 0542
1009                 SLO   LRGSN           PRCT SAND     0542 16 1084 0789
1010                 BMI   NGSN                          0789 46 0592 1393
1011         NGSN    RSL   LOWER                         0592 66 8002 1393
1012                 STL   TRUSN                         1393 20 0597 1050
1013   1
1014                 RAU   SHALE                         1050 60 0772 1178
1015                 NZU           NOSH                  1178 44 1381 0282
1016                 RAU   SAND            CALC RATIO    1381 60 1186 0642
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1017                SRT   0004          OF SAND TO      0642  30 0004 1153
1018                DVR   SHALE         MUD             1153  64 0772 1134
1019                SRD   0004                          1134  31 0004 0647
1020          NOSH  RAL   TSTAA                         0282  65 0156 0647
1021                STL   SA/MD                         0647  20 0351 0354
1022  1
1023                LDD   ZEROS                         0354  69 0087 0790
1024                STD   P0009                         0790  24 0035 0688
1025  1
1026                RAL   SAND          IS PRCT         0688  65 1186 0692
1027                SLO   PC075          SAND LRGR       0692  16 0468 0773
1028                BMI         SET1    THAN 75         0773  46 0576 1228
1029  1
1030                RAL   SILT          NO, SO IS       0576  65 0547 0401
1031                SLO   PC075          PRCT SILT       0401  16 0468 0823
1032                BMI         SET4    LRGR THAN       0823  46 0626 1278
1033  1                                 75
1034  1
1035                RAL   CLAY          NO, SO IS       0626  65 1343 0697
1036                SLO   PC075          PRCT CLAY       0697  16 0468 0873
1037                BMI         SET10   CLAY LRGR       0873  46 0676 1328
1038  1                                 THAN 75
1039  1
1040                RAL   SAND          NO, SO IS       0676  65 1186 0742
1041                SLO   PC020          PRCT SAND       0742  16 0595 0549
1042                BMI   C              LRGR THAN       0549  46 0202 1203
1043  1                                 20
1044  1
1045                RAL   SILT          NO, SO IS       1203  65 0547 0451
1046                SLO   PC020          PRCT SILT       0451  16 0595 0599
1047                BMI   D              LRGR THAN       0599  46 0252 1253
1048  1                                 20
1049  1
1050                RAL   CLAY          NO, SO IS       1253  65 1343 0747
1051                SLO   PC020          PRCT CLAY       0747  16 0595 0649
1052                BMI   E       SET6   LRGR THAN       0649  46 0302 1303
1053  1                                 20
1054  1
1055          C     RAU   CLAY          IS RATIO        0202  60 1343 0797
1056                SRT   0004          CLAY/SILT       0797  30 0004 0757
1057                DVR   SILT          LRGR THAN       0757  64 0547 0807
1058                SLO   CONE          ONE             0807  16 0410 0767
1059                NZE   CAA                           0767  45 0620 0922
1060  1
1061                LDD   N92           EXACTLY         0922  69 0726 1330
1062                STD   P0009   CAA    ONE            1330  24 0035 0620
1063  1
1064          CAA   BMI   CA    CB                      0620  46 0923 0674
1065  1
1066          CA    RAU   CLAY          IS RATIO        0923  60 1343 0847
1067                SRT   0004          CLAY/SAND       0847  30 0004 0857
1068                DVR   SAND          LRGR THAN       0857  64 1186 0897
1069                SLO   CONE          ONE             0897  16 0410 0817
1070                NZE   CAB                           0817  45 0670 0972
1071  1
1072                LDD   N92           EXACTLY         0972  69 0726 1380
1073                STD   P0009   CAB    ONE            1380  24 0035 0670
1074  1
1075          CAB   BMI   SET3    SET7                    0670  46 0973 0724
1076  1
1077          CB    RAU   SAND          IS RATIO        0674  60 1186 0792
1078                SRT   0004          SAND/SILT       0792  30 0004 1353
1079                DVR   SILT          LRGR THAN       1353  64 0547 0907
1080                SLO   CONE          ONE             0907  16 0410 0867
1081                NZE   CBB                           0867  45 0720 1022
1082  1
1083                LDD   N92           EXACTLY         1022  69 0726 0332
1084                STD   P0009   CBB    ONE            0332  24 0035 0720
1085  1
1086          CBB   BMI   SET9    SET8                    0720  46 1023 0774
1087  1
1088  1
1089          D     RAU   CLAY          IS RATIO        0252  60 1343 0947
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1090                SRT    0004          CLAY/SAND      0947  30 0004 0957
1091                DVR    SAND          LRGR THAN      0957  64 1186 0997
1092                SLO    CONE          ONE            0997  16 0410 0917
1093                NZE    DAA                          0917  45 0770 1072
1094  1
1095                LDD    N92           EXACTLY        1072  69 0726 0382
1096                STD    P0009   DAA   ONE            0382  24 0035 0770
1097  1
1098          DAA   BMI    CC      CB                   0770  46 1073 0674
1099  1
1100          CC    RAU    CLAY          IS RATIO       1073  60 1343 1047
1101                SRT    0004          CLAY/SILT      1047  30 0004 1007
1102                DVR    SILT          LRGR THAN      1007  64 0547 1057
1103                SLO    CONE          ONE            1057  16 0410 0967
1104                NZE    DBB                          0967  45 0820 1122
1105  1
1106                LDD    N92           EXACTLY        1122  69 0726 0432
1107                STD    P0009   DBB   ONE            0432  24 0035 0820
1108  1
1109          DBB   BMI    SET2    SET5                 0820  46 1123 0824
1110  1
1111  1
1112          E     RAU    SAND          IS RATIO       0302  60 1186 0842
1113                SRT    0004          SAND/SILT      0842  30 0004 0404
1114                DVR    SILT                         0404  64 0547 1107
1115                SLO    CONE                         1107  16 0410 1017
1116                NZE    EAA                          1017  45 0870 1172
1117  1
1118                LDD    N92                          1172  69 0726 0482
1119                STD    P0009   EAA                  0482  24 0035 0870
1120  1
1121          EAA   BMI    CA      CC                   0870  46 0923 1073
1122  1
1123          SET1  RAL    ONEEE         SET PROPER     1228  65 0130 1286
1124          SET2  RAL    TWOOO          CODE          1123  65 0024 1286
1125          SET3  RAL    THREE         NUMBER IN      0973  65 0288 1286
1126          SET4  RAL    FOURR         P0008          1278  65 0094 1286
1127          SET5  RAL    FIVEE                        0824  65 1378 1286
1128          SET6  RAL    SIXXX                        1303  65 1157 1286
1129          SET7  RAL    SEVEN                        0724  65 0384 1286
1130          SET8  RAL    EIGHT                        0774  65 0532 1286
1131          SET9  RAL    NINEE                        1023  65 0776 1286
1132          SET10 RAL    TENNN                        1328  65 0582 1286
1133  1
1134                ALO    P0009                        1286  15 0035 0839
1135                SLT    0005                         0839  35 0005 0458
1136                STL    P0009                        0458  20 0035 0738
1137  1
1138                RAL    P0004         SET CARD       0738  65 0030 1336
1139                SRT    0001          TYPE           1336  30 0001 0194
1140                SLT    0001          NO. 4          0194  35 0001 0501
1141                ALO    FOURR                        0501  15 0094 0699
1142                STL    P0004                        0699  20 0030 1184
1143  1
1144                RAL    LRGSN         PACK PUNCH     1184  65 1084 0889
1145                SLT    0005          BANDS          0889  35 0005 0551
1146                ALO    TRUSN                        0551  15 0597 0601
1147                STL    P0006                        0601  20 0032 1386
1148  1
1149                RAL    SILT                         1386  65 0547 0651
1150                SLT    0005                         0651  35 0005 0913
1151                ALO    CLAY                         0913  15 1343 1097
1152                STL    P0007                        1097  20 0033 0788
1153  1
1154                RAL    SUMMP                        0788  65 0111 1067
1155                SLT    0005                         1067  35 0005 0632
1156                ALO    SA/MD                        0632  15 0351 1207
1157                STL    P0008                        1207  20 0034 0838
1158  1
1159                LDD    CW010                        0838  69 0991 0244
1160                STD    P0010                        0244  24 0036 0939
1161  1
1162                PCH    P0001         PUNCH CARD     0939  71 0027 0682
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1163    1
1164                RAL     TEST3                   INDICATE        0682  65 0537 0892
1165                ALO     BD004                    SAND SILT      0892  15 0374 0732
1166                STL     TEST3   CC2              CLAY           0732  20 0537 0690
1167    1                                            COMPLETED
1168    1
1169    1                       CALCULATE TRASK VALUES
1170    1
1171        TRASK   RAU     PHI25                   CONVERT         1103  60 0727 0782
1172                MPY     LNE2                     PHI 25 TO      0782  19 0888 0460
1173                LDD     NXTF    ELRGX            MILLIMTRS      0460  69 0963 1750
1174        NXTF    SRD      0003                    FOR Q1         0963  31 0003 1173
1175                STL     FQ1                                     1173  20 0832 0938
1176                SRD      0001                                   0938  31 0001 0645
1177                STL     Q1                                      0645  20 0749 0352
1178    1
1179                RAU     PHI50                   CONVERT         0352  60 0827 0882
1180                MPY     LNE2                                    0882  19 0888 0610
1181                LDD     NXTG    ELRGX            MILLIMTRS      0610  69 1013 1750
1182        NXTG    SRD      0003                    FOR Q2         1013  31 0003 1223
1183                STL     FQ2                                     1223  20 0932 0988
1184                SRD      0001                                   0988  31 0001 0695
1185                STL     Q2                                      0695  20 0799 0402
1186    1
1187                RAU     PHI75                   CONVERT         0402  60 0927 0982
1188                MPY     LNE2                     PHI75 TO       0982  19 0888 0660
1189                LDD     NXTH    ELRGX            MILLIMTRS      0660  69 1063 1750
1190        NXTH    SRD      0003                    FOR Q3         1063  31 0003 1273
1191                STL     FQ3                                     1273  20 1032 1038
1192                SRD      0001                                   1038  31 0001 0745
1193                STL     Q3                                      0745  20 0849 0452
1194    1
1195                RAU     FQ1                     CALC SO         0452  60 0832 1088
1196                SRT      0003                                   1088  30 0003 1147
1197                DVR     FQ3                                     1147  64 1032 0294
1198    1
1199                LDD     NXTR    SQURT                           0294  69 1197 1701
1200        NXTR    SRD      0005                                   1197  31 0005 1011
1201                STL     SO                                      1011  20 1117 0920
1202    1
1203                SLT      0004                   CALC            0920  35 0004 1082
1204                LDD     RNXT    LOG10            LOG SO         1082  69 1138 1855
1205        RNXT    RAL     UPPER                                   1138  65 8003 0795
1206                SRD      0004                                   0795  31 0004 1257
1207                STL     LGSO                                    1257  20 1061 0314
1208    1
1209                RAU     FQ2                     CALC SKG        0314  60 0932 1188
1210                MPY     DISTB                                   1188  19 8001 1111
1211                SRD      0003                                   1111  31 0003 1222
1212                STL     SDN                                     1222  20 1132 1238
1213    1
1214                RAU     FQ1                                     1238  60 0832 1288
1215                MPY     FQ3                                     1288  19 1032 0454
1216                SLT      0005                                   0454  35 0005 1167
1217                DVR     SDN                                     1167  64 1132 0344
1218                LDD     SNXT    SQURT                           0344  69 1247 1701
1219        SNXT    SRD      0006                                   1247  31 0006 1113
1220                STL     SKG                                     1113  20 1217 0970
1221    1
1222                LDD     CW010                   PREPARE TO      0970  69 0991 0394
1223                STD     P0010                    PUNCH          0394  24 0036 0989
1224    1                                            TRASK
1225                RAL     Q1                       VALUES         0989  65 0749 0504
1226                SLT      0005                                   0504  35 0005 1267
1227                ALO     Q2                                      1267  15 0799 0554
1228                STL     P0006                                   0554  20 0032 1338
1229    1
1230                RAL     Q3                                      1338  65 0849 0604
1231                SLT      0005                                   0604  35 0005 1317
1232                ALO     SO                                      1317  15 1117 1272
1233                STL     P0007                                   1272  20 0033 1388
1234    1
1235                RAL     LGSO                                    1388  65 1061 1367
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1236                SLT    0005                                1367  35 0005 1182
1237                ALO    SKG                                 1182  15 1217 1322
1238                STL    P0008                               1322  20 0034 1039
1239  1
1240                LDD    ZEROS                               1039  69 0087 0840
1241                STD    P0009                               0840  24 0035 1089
1242  1
1243                RAL    P0004          SET CARD             1089  65 0030 1139
1244                SRT    0001           TYPE                 1139  30 0001 0845
1245                SLT    0001           NO. 5                0845  35 0001 0701
1246                ALO    FIVEE                               0701  15 1378 1234
1247                STL    P0004                               1234  20 0030 1284
1248  1
1249  1
1250                PCH    P0001          PUNCH CARD           1284  71 0027 1232
1251  1
1252                RAL    TEST3          INDICATE             1232  65 0537 0942
1253                ALO    BD001           TRASK               0942  15 0224 1282
1254                STL    TEST3    CC2    VALUES              1282  20 0537 0690
1255  1                                    FINISHED
1256  1
1257  1                 CALCULATE INMAN VALUES
1258  1
1259          INMAN RAL    P1CW                                0360  65 1163 0768
1260                ALO    CW010                               0768  15 0991 0895
1261                STL    P0010                               0895  20 0036 1189
1262  1
1263                RAU    PHI16          CALC PHI             1189  60 0627 1332
1264                AUP    PHI84          MEAN DIAM            1332  10 1027 1382
1265                MPY    FIVEE                               1382  19 1378 0899
1266                SRD    0001                                0899  31 0001 1357
1267                STL    F1MD                                1357  20 1161 0364
1268  1
1269                RAU    PHI84          CALC PHI             0364  60 1027 1334
1270                SUP    PHI16           DEVIATION           1334  11 0627 1384
1271                MPY    FIVEE           MEASURE             1384  19 1378 0949
1272                SRD    0001                                0949  31 0001 0508
1273                STL    FIDV                                0508  20 1213 0818
1274                BM1           CISK                         0818  46 1372 1323
1275  1
1276                RAL    CW002                               1372  65 1237 0992
1277                ALO    P0010                               0992  15 0036 1042
1278                STL    P0010    CISK                       1042  20 0036 1323
1279  1
1280          CISK  RAU    F1MD           CALC PHI             1323  60 1161 0868
1281                SUP    PH150           SKEWNESS            0868  11 0827 1239
1282                SRT    0002            MEASURE             1239  30 0002 0945
1283                DVR    FIDV                                0945  64 1213 1373
1284                SRD    0006                                1373  31 0006 1289
1285                STL    FISK                                1289  20 0444 1297
1286  1
1287                RAU    PH195          CALC 2ND             1297  60 1127 1339
1288                SUP    TSTAA           PHI                 1339  11 0156 1211
1289                NZU           CANT     SKEWNESS            1211  44 0918 0968
1290                AUP    DISTB           MEASURE             0918  10 8001 0826
1291                AUP    PHI05                               0826  10 0711 1018
1292                MPY    FIVEE                               1018  19 1378 0999
1293                SRD    0001                                0999  31 0001 0558
1294                SLO    PH150                               0558  16 0827 1389
1295                RAU    LOWER                               1389  60 8002 1347
1296                SRT    0002                                1347  30 0002 0654
1297                DVR    FIDV                                0654  64 1213 0874
1298                SRD    0006                                0874  31 0006 1092
1299                STL    F2SK                                1092  20 1397 1150
1300                BM1           CIKU                         1150  46 0704 0754
1301  1
1302                RAL    CW003                               0704  65 1337 1142
1303                ALO    P0010                               1142  15 0036 1192
1304                STL    P0010    CIKU                       1192  20 0036 0754
1305  1
1306          CIKU  RAU    PH195          CALC PHI             0754  60 1127 0890
1307                SUP    PHI05           KURTOSIS            0890  11 0711 1068
1308                MPY    FIVEE           MEASURE             1068  19 1378 1049
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1309                SRD     0001                                1049  31 0001 0608
1310                RAU     LOWER                               0608  60 8002 1118
1311                SUP     FIDV                                1118  11 1213 1168
1312                SRT     0002                                1168  30 0002 0876
1313                DVR     DISTB                               0876  64 8001 0940
1314                SRD     0006                                0940  31 0006 0658
1315                STL     FIKU    PCHI                        0658  20 1263 1218
1316  1
1317          CANT  LDD     TSTAA                               0968  69 0156 0710
1318                STD     F2SK                                0710  24 1397 1200
1319                STD     F1KU    PCHI                        1200  24 1263 1218
1320  1
1321          PCHI  RAM     PHI50           PREPARE TO          1218  67 0827 0990
1322                SLT     0005             PUNCH              0990  35 0005 0804
1323                AML     F1MD             INMAN              0804  17 1161 1268
1324                STL     P0006            VALUES             1268  20 0032 1040
1325  1
1326                RAM     F1DV                                1040  67 1213 1318
1327                SLT     0005                                1318  35 0005 1090
1328                AML     FISK                                1090  17 0444 1099
1329                STL     P0007                               1099  20 0033 1140
1330  1
1331                RAM     F2SK                                1140  67 1397 0751
1332                SLT     0005                                0751  35 0005 1313
1333                AML     FIKU                                1313  17 1263 1368
1334                STL     P0008                               1368  20 0034 1190
1335  1
1336                LDD     ZEROS                               1190  69 0087 1240
1337                STD     P0009                               1240  24 0035 1290
1338  1
1339                RAL     FIMD            TEST FOR            1290  65 1161 0419
1340                BMI     NGJ     PSJ      NEGATIVE           0419  46 0924 0974
1341          PSJ   RAL     FISK             VALUES             0974  65 0444 1149
1342                BMI     NGK     PSK                         1149  46 0502 0854
1343          PSK   RAL     F1KU                                0854  65 1263 0469
1344                BMI     NGL     PSL                         0469  46 1024 1074
1345  1
1346          NGJ   RSL     P0006                               0924  66 0032 1340
1347                STL     P0006   PSJ                         1340  20 0032 0974
1348          NGK   RSL     P0007                               0502  66 0033 1390
1349                STL     P0007   PSK                         1390  20 0033 0854
1350          NGL   RSL     P0008                               1024  66 0034 1242
1351                STL     P0008   PSL                         1242  20 0034 1074
1352  1
1353          PSL   RAL     P0004           SET CARD            1074  65 0030 1292
1354                SRT     0001             TYPE               1292  30 0001 1199
1355                SLT     0001             NO. 6              1199  35 0001 0708
1356                AML     SIXXX                               0708  17 1157 1261
1357                STL     P0004                               1261  20 0030 1342
1358  1
1359                PCH     P0001           PUNCH CARD          1342  71 0027 1392
1360  1
1361                RAL     TEST3           INMAN CALC          1392  65 0537 0494
1362                ALO     BD002            COMPLETED          0494  15 0274 0544
1363                STL     TEST3   CC2                         0544  20 0537 0690
1364  1
1365  1
1366  1             CALCULATE FOLK AND WARD
1367  1             VALUES
1368  1
1369          FANDW LDD     CW010                               0264  69 0991 0594
1370                STD     P0010                               0594  24 0036 0644
1371  1
1372                RAU     PHI16           CALC MZ             0644  60 0627 0694
1373                AUP     PHI50           MEDIAN              0694  10 0827 0744
1374                AUP     PH184           DIAMETER            0744  10 1027 0794
1375  1
1376                MPY     RCP3                                0844  19 0448 0519
1377                SRD     0005                                0519  31 0005 0894
1378                SLT     0005                                0894  35 0005 0758
1379                BMI     NGMZ                                0758  46 1311 0612
1380                STL     P0006   CLSD                        0612  20 0032 0944
1381  1
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1382          NGMZ    RAM     LOWER                          1311  67 8002 0569
1383                  STL     P0006                          0569  20 0032 0994
1384                  RAL     CW001                          0994  65 0672 1044
1385                  ALO     P0010                          1044  15 0036 1094
1386                  STL     P0010   CLSD                   1094  20 0036 0944
1387  1
1388          CLSD    RAU     PH184           CALCULATE      0944  60 1027 1144
1389                  SUP     PH116            STANDARD      1144  11 0627 1194
1390                  MPY     QTR              DEVIATION     1194  19 0498 0619
1391                  SRD      0002                          0619  31 0002 1244
1392                  STL     FST                            1244  20 1249 0552
1393  1
1394                  RAU     PH195                          0552  60 1127 1294
1395                  SUP     PH105                          1294  11 0711 0669
1396                  STU     F955                           0669  21 1124 1344
1397                  MPY     RC66                           1344  19 0548 0719
1398                  SRD      0005                          0719  31 0005 1394
1399                  ALO     FST                            1394  15 1249 0904
1400                  SLT      0002                          0904  35 0002 1361
1401                  STL     TLFA                           1361  20 0769 1174
1402                  SLT      0003                          1174  35 0003 0995
1403                  STL     P0007                          0995  20 0033 1045
1404  1
1405                  BM1             CLSK                   1045  46 0598 1299
1406                  RAM     LOWER                          0598  67 8002 0808
1407                  STL     P0007                          0808  20 0033 1095
1408                  RAL     CW002                          1095  65 1237 1145
1409                  ALO     P0010                          1145  15 0036 1195
1410                  STL     P0010   CLSK                   1195  20 0036 1299
1411  1
1412          CLSK    RAU     F1SK            CALCULATE      1299  60 0444 1349
1413                  MPY     FIVEE           SKEWNESS       1349  19 1378 1399
1414                  SRD      0001                          1399  31 0001 0858
1415  1
1416                  STL     SKT                            0858  20 1363 0819
1417                  RAU     PH195                          0819  60 1127 1245
1418                  SUP     PH105                          1245  11 0711 0869
1419                  AUP     UPPER                          0869  10 8003 1295
1420                  SRT      0004                          1295  30 0004 0908
1421                  STL     DN2                            0908  20 0414 0919
1422  1
1423                  RAU     PH105                          0919  60 0711 0969
1424                  AUP     PH195                          0969  10 1127 1345
1425                  SUP     PH150                          1345  11 0827 1395
1426                  SUP     D1STB                          1395  11 8001 0954
1427                  DVR     DN2                            0954  64 0414 0926
1428                  SRD      0002                          0926  31 0002 0546
1429                  ALO     SKT                            0546  15 1363 1019
1430                  SLT      0005                          1019  35 0005 0596
1431                  STL     P0008                          0596  20 0034 0646
1432                  SRT      0002           ADD 12 TO      0646  30 0002 1004
1433                  ALO     TWELV           SKEWNESS       1004  15 0958 0464
1434                  STL     TLFB            FOR TLU        0464  20 1069 1224
1435  1
1436                  RAL     P0008                          1224  65 0034 0696
1437                  BM1             CLKG                   0696  46 1250 1300
1438  1
1439                  RAM     P0008                          1250  67 0034 0746
1440                  STL     P0008                          0746  20 0034 0796
1441                  RAL     CW003                          0796  65 1337 0846
1442                  ALO     P0010                          0846  15 0036 0896
1443                  STL     P0010   CLKG                   0896  20 0036 1300
1444  1
1445          CLKG    RAU     PH175           CALCULATE      1300  60 0927 0946
1446                  SUP     PH125            KURTOSIS      0946  11 0727 0996
1447                  MPY     C244                           0996  19 1350 1274
1448                  STL     DN                             1274  20 1046 0801
1449  1
1450                  RAU     F955                           0801  60 1124 1096
1451                  DVR     DN                             1096  64 1046 1008
1452                  SRD      0006                          1008  31 0006 0976
1453                  SLT      0005                          0976  35 0005 1146
1454                  STL     P0009                          1146  20 0035 1196
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1455                    SLT     0001                            1196  35 0001 1054
1456                    STL     TLFC                            1054  20 0760 0514
1457  1
1458                    BMI     NGKG    TLUF                    0514  46 1119 1169
1459  1
1460          NGKG      RAM     P0009                           1119  67 0035 1246
1461                    STL     P0009                           1246  20 0035 1296
1462  1
1463                    RAL     CW004                           1296  65 1387 1346
1464                    ALO     P0010                           1346  15 0036 1396
1465                    STL     P0010   TLUF                    1396  20 0036 1169
1466  1
1467          TLUF      RAL     NXFA            USE TLU         1169  65 1324 0648
1468                    LDD     TLFA            FOR CODING      0648  69 0769 1374
1469                    TLU     D0001   LOWER   STANDARD        1374  84 1650 8002
1470          NXFA      RAU     D0001           DEVIATION       1324  60 1650 1058
1471                    SLT      0009                           1058  35 0009 0698
1472                    SRT      0009                           0698  30 0009 1219
1473                    AUP     P0007                           1219  10 0033 0748
1474                    STU     P0007                           0748  21 0033 0798
1475  1
1476                    RAL     NXFB            SKEWNESS        0798  65 0851 1108
1477                    LDD     TLFB                            1108  69 1069 1026
1478                    TLU     D0001   LOWER                   1026  84 1650 8002
1479          NXFB      RAU     D0001                           0851  60 1650 1158
1480                    SLT      0009                           1158  35 0009 0848
1481                    SRT      0009                           0848  30 0009 1269
1482                    AUP     P0008                           1269  10 0034 0898
1483                    STU     P0008                           0898  21 0034 0948
1484  1
1485                    RAL     NXFC            KURTOSIS        0948  65 0901 1208
1486                    LDD     TLFC                            1208  69 0760 0564
1487                    TLU     D0001   LOWER                   0564  84 1650 8002
1488          NXFC      RAU     D0001                           0901  60 1650 1258
1489                    SLT      0009                           1258  35 0009 0998
1490                    SRT      0009                           0998  30 0009 1319
1491                    AUP     P0009                           1319  10 0035 1048
1492                    STU     P0009                           1048  21 0035 1098
1493  1
1494                    RAL     P0004           SET CARD        1098  65 0030 1148
1495                    SRT      0001            TYPE           1148  30 0001 1308
1496                    SLT      0001            NO. 7          1308  35 0001 1369
1497                    ALO     SEVEN                           1369  15 0384 1198
1498                    STL     P0004                           1198  20 0030 1248
1499  1
1500                    PCH     P0001           PUNCH CARD      1248  71 0027 1298
1501  1
1502                    RAL     TEST3           FANDW           1298  65 0537 1348
1503                    ALO     BD003            VALUES         1348  15 0324 1398
1504                    STL     TEST3   CC2      FINISHED       1398  20 0537 0690
1505  1
1506  1                   INITIALIZING BLOCK
1507  1
1508          INITL     RAL     TSTAA           SET ALL         0011  65 0156 0662
1509                    AUP     INAA    UPPER    CELLS IN       0662  10 1020 8003
1510          INAA      STL     C0050   INA8     REGIONS        1020  20 1649 0602
1511          INAB      SUP     DA001            A, B, C        0602  11 0016 1076
1512                    SUP     INB              TO 99999       1076  11 0951 1358
1513                    BMI     INOT                            1358  46 0712 0762
1514                    AUP     DIST8   UPPER                   0762  10 8001 8003
1515          INB       STL     A0001   INA8                    0951  20 1500 0602
1516  1
1517          INOT      LDD     ORGA1                           0712  69 0750 1104
1518                    STD     AA111                           1104  24 0143 1001
1519  1
1520                    LDD     ORGA2                           1001  69 0800 1154
1521                    STD     AA222                           1154  24 0115 1070
1522  1
1523                    LDD     ORGOT                           1070  69 0850 1204
1524                    STD     TTOUT                           1204  24 0407 0810
1525  1
1526                    LDD     ATESS                           0810  69 0153 0860
1527                    STD     TEST1                           0860  24 0167 1120
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1528                    STD     TEST3                           1120  24 0537 1051
1529    1
1530                    LDD     ZEROS                           1051  69 0087 1101
1531                    STD     PICW                            1101  24 1163 1170
1532                    STD     SUMMP                           1170  24 0111 0614
1533                    STD     P0006                           0614  24 0032 1151
1534                    STD     P0007                           1151  24 0033 1201
1535                    STD     P0008                           1201  24 0034 1251
1536                    STD     P0009                           1251  24 0035 1301
1537                    STD     A0001                           1301  24 1500 1254
1538                    STD     B0001                           1254  24 1550 1304
1539                    STD     TEST6                           1304  24 1059 0812
1540                    STD     TEST7                           0812  24 0449 0652
1541                    STD     CRDCT                           0652  24 0186 1351
1542    1
1543                    LDD     TSTAA                           1351  69 0156 0910
1544                    STD     PHI05                           0910  24 0711 0664
1545                    STD     PHI16                           0664  24 0627 0702
1546                    STD     PHI25                           0702  24 0727 0752
1547                    STD     PHI50                           0752  24 0827 0802
1548                    STD     PHI75                           0802  24 0927 0852
1549                    STD     PHI84                           0852  24 1027 0902
1550                    STD     PHI95                           0902  24 1127 0952
1551    1
1552                    LDD     FOURR                           0952  69 0094 1002
1553                    STD     TEST4                           1002  24 0586 1052
1554    1
1555                    LDD     ORGM1                           1052  69 0296 1102
1556                    STD     M0001                           1102  24 1681 1152
1557    1
1558                    LDD     ORGM2                           1152  69 0787 1202
1559                    STD     M0002                           1202  24 1682 1252
1560    1
1561                    LDD     CW010                           1252  69 0991 1302
1562                    STD     P0010   DATA1                   1302  24 0036 0050
1563    1
1564    1                       TABLE OF CONSTANTS
1565    1
1566            DA001   00      0001    0000                    0016  00 0001 0000
1567            DA002   00      0002    0000                    0132  00 0002 0000
1568            DA010   00      0010    0000                    0388  00 0010 0000
1569            DA050   00      0050    0000                    0116  00 0050 0000
1570            DA100   00      0100    0000                    1080  00 0100 0000
1571            DI104   00      0001    0004                    0182  00 0001 0004
1572            DA551   00      1551    0000                    0090  00 1551 0000
1573    1
1574            INCDA   00      0001    0000                    0250  00 0001 0000
1575            CDATT   00      0001    0021                    0232  00 0001 0021
1576    1
1577            BD001   00      0000    0001                    0224  00 0000 0001
1578            BD002   00      0000    0010                    0274  00 0000 0010
1579            BD003   00      0000    0100                    0324  00 0000 0100
1580            BD004   00      0000    1000                    0374  00 0000 1000
1581            BD005   00      0001    0000                    0424  00 0001 0000
1582            BD006   00      0010    0000                    0474  00 0010 0000
1583            BD007   00      0100    0000                    0524  00 0100 0000
1584    1
1585            PC005   00      0000    0500                    0118  00 0000 0500
1586            PC016   00      0000    1600                    0218  00 0000 1600
1587            PC020   00      0000    2000                    0595  00 0000 2000
1588            PC025   00      0000    2500                    0318  00 0000 2500
1589            PC050   00      0000    5000                    0286  00 0000 5000
1590            PC072   00      0000    7200                    0178  00 0000 7200
1591            PC075   00      0000    7500                    0468  00 0000 7500
1592            PC081   00      0000    8100                    0228  00 0000 8100
1593            PC084   00      0000    8400                    0518  00 0000 8400
1594            PC092   00      0000    9200                    0278  00 0000 9200
1595            PC095   00      0000    9500                    0618  00 0000 9500
1596            PC100   00      0001    0000                    0018  00 0001 0000
1597    1
1598          - TT005   00      0000    1645                    0256  00 0000 1645
1599          - TT016   00      0000    0995                    0306  00 0000 0995
1600          - TT025   00      0000    0674                    0356  00 0000 0674
```

```
1601          TT050     00     0000     0000                          0406   00 0000 0000
1602          TT075     00     0000     0674                          0456   00 0000 0674
1603          TT084     00     0000     0995                          0506   00 0000 0995
1604          TT095     00     0000     1645                          0556   00 0000 1645
1605    1
1606          PHI-1     00     0000     0900                          0545   00 0000 0900
1607          PHI4      00     0000     1400                          0445   00 0000 1400
1608          PHI8      00     0000     1800                          1236   00 0000 1800
1609          PHI10     00     0000     1000                          0038   00 0000 1000
1610    1
1611          ZEROS     00     0000     0000                          0087   00 0000 0000
1612          ONEEE     00     0000     0001                          0130   00 0000 0001
1613          TWOOO     00     0000     0002                          0024   00 0000 0002
1614          THREE     00     0000     0003                          0288   00 0000 0003
1615          FOURR     00     0000     0004                          0094   00 0000 0004
1616          FIVEE     00     0000     0005                          1378   00 0000 0005
1617          SIXXX     00     0000     0006                          1157   00 0000 0006
1618          SEVEN     00     0000     0007                          0384   00 0000 0007
1619          EIGHT     00     0000     0008                          0532   00 0000 0008
1620          NINEE     00     0000     0009                          0776   00 0000 0009
1621          TENNN     00     0000     0010                          0582   00 0000 0010
1622          TWELV     00     0120     0000                          0958   00 0120 0000
1623          TWNTY     00     0000     0020                          0412   00 0000 0020
1624          4.090     00     0000     4090                          0088   00 0000 4090
1625    1
1626          CW001     00     0008     0000                          0672   00 0008 0000
1627          CW002     00     0000     8000                          1237   00 0000 8000
1628          CW003     00     0000     0800                          1337   00 0000 0800
1629          CW004     00     0000     0080                          1387   00 0000 0080
1630          CW010     00     0000     0008                          0991   00 0000 0008
1631    1
1632          ATESS     88     8888     8888                          0153   88 8888 8888
1633    1
1634        - LNE2      00     0693     1472                          0888   00 0693 1472
1635    1
1636          TSTAA     00     0009     9999                          0156   00 0009 9999
1637    1
1638          CONE      00     0100     0000                          0410   00 0100 0000
1639    1
1640          RCP3      00     0003     3333                          0448   00 0003 3333
1641          RC66      00     0001     5152                          0548   00 0001 5152
1642    1
1643          QTR       00     0000     0025                          0498   00 0000 0025
1644          C244      00     0000     0244                          1350   00 0000 0244
1645    1
1646          N92       00     0000     0200                          0726   00 0000 0200
1647    1
1648                    SEQ    D0001
1649          *         00     0000     0000     CONSTANTS            1650   00 0000 0000
1650          *         00     0000     3501     FOR TLU              1651   00 0000 3501
1651          *         00     0000     5002     OF F AND W           1652   00 0000 5002
1652          *         00     0001     0003     SORTING              1653   00 0001 0003
1653          *         00     0002     0004                          1654   00 0002 0004
1654          *         00     0004     0005                          1655   00 0004 0005
1655          *         00     0009     9996                          1656   00 0009 9996
1656    1
1657          *         00     0090     0000     CONSTANTS            1657   00 0090 0000
1658          *         00     0100     0000     FOR TLU              1658   00 0100 0000
1659          *         00     0117     0001     F AND W              1659   00 0117 0001
1660          *         00     0119     0002     SKEWNESS             1660   00 0119 0002
1661          *         00     0121     0003                          1661   00 0121 0003
1662          *         00     0123     0004                          1662   00 0123 0004
1663          *         00     2222     0005                          1663   00 2222 0005
1664    1
1665          *         00     9000     0001     CONSTANTS            1664   00 9000 0001
1666          *         01     1100     0002     FOR TLU              1665   01 1100 0002
1667          *         01     5000     0003     OF F AND W           1666   01 5000 0003
1668          *         03     0000     0004     KURTOSIS             1667   03 0000 0004
1669          *         99     9999     9995                          1668   99 9999 9995
1670    1
1671    1
1672                    SEQ    T0001
1673    1
```

```
1674    *    00    0000    0000    TABLE OF          1400    00    0000    0000
1675    *    00    0000    0000    T-VALUES          1401    00    0000    0000
1676    *    00    0120    0030                      1402    00    0120    0030
1677    *    00    2390    0060                      1403    00    2390    0060
1678    *    00    3590    0090                      1404    00    3590    0090
1679    *    00    4780    0120    DIGITS IN         1405    00    4780    0120
1680    *    00    5960    0150    OP AND DA         1406    00    5960    0150
1681    *    00    7140    0180    POSITIONS         1407    00    7140    0180
1682    *    00    8320    0210    ARE               1408    00    8320    0210
1683    *    00    9480    0240    PERCENTS.         1409    00    9480    0240
1684    *    01    0640    0270    VALUES IN         1410    01    0640    0270
1685    *    01    1790    0300    IA ARE            1411    01    1790    0300
1686    *    01    2930    0330    T-VALUES          1412    01    2930    0330
1687    *    01    4060    0360                      1413    01    4060    0360
1688    *    01    5170    0390                      1414    01    5170    0390
1689    *    01    6280    0420                      1415    01    6280    0420
1690    *    01    7360    0450                      1416    01    7360    0450
1691    *    01    8440    0480                      1417    01    8440    0480
1692    *    01    9500    0510                      1418    01    9500    0510
1693    *    02    0540    0540                      1419    02    0540    0540
1694    *    02    1570    0570                      1420    02    1570    0570
1695    *    02    2570    0600                      1421    02    2570    0600
1696    *    02    3570    0630                      1422    02    3570    0630
1697    *    02    4540    0660                      1423    02    4540    0660
1698    *    02    5490    0690                      1424    02    5490    0690
1699    *    02    6420    0720                      1425    02    6420    0720
1700    *    02    7340    0750                      1426    02    7340    0750
1701    *    02    8230    0780                      1427    02    8230    0780
1702    *    02    9100    0810                      1428    02    9100    0810
1703    *    02    9950    0840                      1429    02    9950    0840
1704    *    03    0780    0870                      1430    03    0780    0870
1705    *    03    1590    0900                      1431    03    1590    0900
1706    *    03    2380    0930                      1432    03    2380    0930
1707    *    03    3150    0960                      1433    03    3150    0960
1708    *    03    3890    0990                      1434    03    3890    0990
1709    *    03    4610    1020                      1435    03    4610    1020
1710    *    03    5310    1050                      1436    03    5310    1050
1711    *    03    5990    1080                      1437    03    5990    1080
1712    *    03    6650    1110                      1438    03    6650    1110
1713    *    03    7290    1140                      1439    03    7290    1140
1714    *    03    7900    1170                      1440    03    7900    1170
1715    *    03    8490    1200                      1441    03    8490    1200
1716    *    03    9070    1230                      1442    03    9070    1230
1717    *    03    9620    1260                      1443    03    9620    1260
1718    *    04    0150    1290                      1444    04    0150    1290
1719    *    04    0660    1320                      1445    04    0660    1320
1720    *    04    1150    1350                      1446    04    1150    1350
1721    *    04    1620    1380                      1447    04    1620    1380
1722    *    00    0000    0000    SPACER            1448    00    0000    0000
1723    *    00    0000    0000    SPACER            1449    00    0000    0000
1724    *    04    2070    1410                      1450    04    2070    1410
1725    *    04    2510    1440                      1451    04    2510    1440
1726    *    04    2920    1470                      1452    04    2920    1470
1727    *    04    3320    1500                      1453    04    3320    1500
1728    *    04    3700    1530                      1454    04    3700    1530
1729    *    04    4060    1560                      1455    04    4060    1560
1730    *    04    4410    1590                      1456    04    4410    1590
1731    *    04    4740    1620                      1457    04    4740    1620
1732    *    04    5050    1650                      1458    04    5050    1650
1733    *    04    5350    1680                      1459    04    5350    1680
1734    *    04    5640    1710                      1460    04    5640    1710
1735    *    04    5910    1740                      1461    04    5910    1740
1736    *    04    6160    1770                      1462    04    6160    1770
1737    *    04    6410    1800                      1463    04    6410    1800
1738    *    04    6640    1830                      1464    04    6640    1830
1739    *    04    6860    1860                      1465    04    6860    1860
1740    *    04    7060    1890                      1466    04    7060    1890
1741    *    04    7260    1920                      1467    04    7260    1920
1742    *    04    7440    1950                      1468    04    7440    1950
1743    *    04    7610    1980                      1469    04    7610    1980
1744    *    04    7780    2010                      1470    04    7780    2010
1745    *    04    7930    2040                      1471    04    7930    2040
1746    *    04    8080    2070                      1472    04    8080    2070
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1747        *       04    8210    2100
1748        *       04    8340    2130
1749        *       04    8460    2160
1750        *       04    8570    2190
1751        *       04    8680    2220
1752        *       04    8780    2250
1753        *       04    8870    2280
1754        *       04    8960    2310
1755        *       04    9040    2340
1756        *       04    9110    2370
1757        *       04    9200    2410
1758        *       04    9310    2460
1759        *       04    9400    2510
1760        *       04    9600    2650
1761        *       04    9700    2750
1762        *       04    9800    2880
1763        *       04    9900    3080
1764        *       05    0000    4090
1765    1
1766    1
1767                PAT
1768                PST
1769                END   START
```

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1473    04  8210  2100
1474    04  8340  2130
1475    04  8460  2160
1476    04  8570  2190
1477    04  8680  2220
1478    04  8780  2250
1479    04  8870  2280
1480    04  8960  2310
1481    04  9040  2340
1482    04  9110  2370
1483    04  9200  2410
1484    04  9310  2460
1485    04  9400  2510
1486    04  9600  2650
1487    04  9700  2750
1488    04  9800  2880
1489    04  9900  3080
1490    05  0000  4090
```

APPENDIX 4 Listing of Sediment Description Program (# 0213) for IBM 709 Computer

```
C       PROGRAM FOR COMPUTING STATISTICS ON MARINE SEDIMENTS                    SDP-0001
C       ROUTINE  0213  FOR THE IBM 709 COMPUTER                                 SDP-0002
C       PREPARED BY  E. E. COLLIAS AND M. R. RONA                               SDP-0003
C       DECEMBER 20  1960                                                       SDP-0004
C                                                                               SDP-0005
        DIMENSION PHI(100), FRWT(100), PRCT(100), FRPC(100), ACPC(100),         SDP-0006
       1T(100), TBLPC(100), TBLT(100), TLFD(20),ITLFDC(20), TLFS(20),           SDP-0007
       2ITLFSC(20),TLFK(20),ITLFKC(20), PHIMA(20), PHIMB(20), CRMC(20),         SDP-0008
       3STMC(20), EXMC(20), CRMB(20), STMP(20), EXMB(20), CRMT(20),             SDP-0009
       4STMB(20), STAC(20), MA(30), MAT(30), MB(30), MBT(30), MC(30)            SDP-0010
C                                                                               SDP-0011
C       TABLE OF PERCENTS FOR TABLE (TBLPC)                                     SDP-0012
C                                                                               SDP-0013
        TBLPC (01) = 00.00                                                      SDP-0014
        TBLPC (02) = 01.20                                                      SDP-0015
        TBLPC (03) = 03.59                                                      SDP-0016
        TBLPC (04) = 04.78                                                      SDP-0017
        TBLPC (05) = 05.96                                                      SDP-0018
        TBLPC (06) = 07.14                                                      SDP-0019
        TBLPC (07) = 08.32                                                      SDP-0020
        TBLPC (08) = 09.48                                                      SDP-0021
        TBLPC (09) = 10.64                                                      SDP-0022
        TBLPC (10) = 11.79                                                      SDP-0023
        TBLPC (11) = 12.93                                                      SDP-0024
        TBLPC (12) = 14.60                                                      SDP-0025
        TBLPC (13) = 15.17                                                      SDP-0026
        TBLPC (14) = 16.28                                                      SDP-0027
        TBLPC (15) = 17.36                                                      SDP-0028
        TBLPC (16) = 18.44                                                      SDP-0029
        TBLPC (17) = 19.50                                                      SDP-0030
        TBLPC (18) = 20.54                                                      SDP-0031
        TBLPC (19) = 21.57                                                      SDP-0032
        TBLPC (20) = 22.57                                                      SDP-0033
        TBLPC (21) = 23.57                                                      SDP-0034
        TBLPC (22) = 24.54                                                      SDP-0035
        TBLPC (23) = 25.49                                                      SDP-0036
        TBLPC (24) = 26.42                                                      SDP-0037
        TBLPC (25) = 27.34                                                      SDP-0038
        TBLPC (26) = 28.23                                                      SDP-0039
        TBLPC (27) = 29.10                                                      SDP-0040
        TBLPC (28) = 29.95                                                      SDP-0041
        TBLPC (29) = 30.78                                                      SDP-0042
        TBLPC (30) = 31.59                                                      SDP-0043
        TBLPC (31) = 32.38                                                      SDP-0044
        TBLPC (32) = 33.15                                                      SDP-0045
        TBLPC (33) = 33.89                                                      SDP-0046
        TBLPC (34) = 34.61                                                      SDP-0047
        TBLPC (35) = 35.31                                                      SDP-0048
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TBLPC (36) = 35.99                                                  SDP-0049
TBLPC (37) = 36.65                                                  SDP-0050
TBLPC (38) = 37.29                                                  SDP-0051
TBLPC (39) = 37.90                                                  SDP-0052
TBLPC (40) = 38.49                                                  SDP-0053
TBLPC (41) = 39.07                                                  SDP-0054
TBLPC (42) = 39.62                                                  SDP-0055
TBLPC (43) = 40.15                                                  SDP-0056
TBLPC (44) = 40.66                                                  SDP-0057
TBLPC (45) = 41.15                                                  SDP-0058
TBLPC (46) = 41.62                                                  SDP-0059
TBLPC (47) = 42.07                                                  SDP-0060
TBLPC (48) = 42.51                                                  SDP-0061
TBLPC (49) = 42.92                                                  SDP-0062
TBLPC (50) = 43.20                                                  SDP-0063
TBLPC (51) = 43.70                                                  SDP-0064
TBLPC (52) = 44.06                                                  SDP-0065
TBLPC (53) = 44.10                                                  SDP-0066
TBLPC (54) = 44.74                                                  SDP-0067
TBLPC (55) = 45.05                                                  SDP-0068
TBLPC (56) = 45.35                                                  SDP-0069
TBLPC (57) = 45.64                                                  SDP-0070
TBLPC (58) = 45.91                                                  SDP-0071
TBLPC (59) = 46.16                                                  SDP-0072
TBLPC (60) = 46.41                                                  SDP-0073
TBLPC (61) = 46.64                                                  SDP-0074
TBLPC (62) = 46.86                                                  SDP-0075
TBLPC (63) = 47.06                                                  SDP-0076
TBLPC (64) = 47.26                                                  SDP-0077
TBLPC (65) = 47.44                                                  SDP-0078
TBLPC (66) = 47.61                                                  SDP-0079
TBLPC (67) = 47.78                                                  SDP-0080
TBLPC (68) = 47.93                                                  SDP-0081
TBLPC (69) = 48.08                                                  SDP-0082
TBLPC (70) = 48.21                                                  SDP-0083
TBLPC (71) = 48.34                                                  SDP-0084
TBLPC (72) = 48.46                                                  SDP-0085
TBLPC (73) = 48.57                                                  SDP-0086
TBLPC (74) = 48.68                                                  SDP-0087
TBLPC (75) = 48.78                                                  SDP-0088
TBLPC (76) = 48.87                                                  SDP-0089
TBLPC (77) = 48.96                                                  SDP-0090
TBLPC (78) = 49.04                                                  SDP-0091
TBLPC (79) = 49.11                                                  SDP-0092
TBLPC (80) = 49.20                                                  SDP-0093
TBLPC (81) = 49.31                                                  SDP-0094
TBLPC (82) = 49.40                                                  SDP-0095
TBLPC (83) = 49.60                                                  SDP-0096
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      TBLPC (84) = 49.70                                                SDP-0097
      TBLPC (85) = 49.80                                                SDP-0098
      TBLPC (86) = 49.90                                                SDP-0099
      TBLPC (87) = 50.00                                                SDP-0100
C                                                                       SDP-0101
C                                                                       SDP-0102
      TBLT  (01) =  0.000                                               SDP-0103
      TBLT  (02) =  0.030                                               SDP-0104
      TBLT  (03) =  0.090                                               SDP-0105
      TBLT  (04) =  0.120                                               SDP-0106
      TBLT  (05) =  0.150                                               SDP-0107
      TBLT  (06) =  0.180                                               SDP-0108
      TBLT  (07) =  0.210                                               SDP-0109
      TBLT  (08) =  0.240                                               SDP-0110
      TBLT  (09) =  0.270                                               SDP-0111
      TBLT  (10) =  0.300                                               SDP-0112
      TBLT  (11) =  0.330                                               SDP-0113
      TBLT  (12) =  0.360                                               SDP-0114
      TBLT  (13) =  0.390                                               SDP-0115
      TBLT  (14) =  0.420                                               SDP-0116
      TBLT  (15) =  0.450                                               SDP-0117
      TBLT  (16) =  0.480                                               SDP-0118
      TBLT  (17) =  0.510                                               SDP-0119
      TBLT  (18) =  0.540                                               SDP-0120
      TBLT  (19) =  0.570                                               SDP-0121
      TBLT  (20) =  0.600                                               SDP-0122
      TBLT  (21) =  0.630                                               SDP-0123
      TBLT  (22) =  0.660                                               SDP-0124
      TBLT  (23) =  0.690                                               SDP-0125
      TBLT  (24) =  0.720                                               SDP-0126
      TBLT  (25) =  0.750                                               SDP-0127
      TBLT  (26) =  0.780                                               SDP-0128
      TBLT  (27) =  0.810                                               SDP-0129
      TBLT  (28) =  0.840                                               SDP-0130
      TBLT  (29) =  0.870                                               SDP-0131
      TBLT  (30) =  0.900                                               SDP-0132
      TBLT  (31) =  0.930                                               SDP-0133
      TBLT  (32) =  0.960                                               SDP-0134
      TBLT  (33) =  0.990                                               SDP-0135
      TBLT  (34) =  1.020                                               SDP-0136
      TBLT  (35) =  1.050                                               SDP-0137
      TBLT  (36) =  1.080                                               SDP-0138
      TBLT  (37) =  1.110                                               SDP-0139
      TBLT  (38) =  1.140                                               SDP-0140
      TBLT  (39) =  1.170                                               SDP-0141
      TBLT  (40) =  1.200                                               SDP-0142
      TBLT  (41) =  1.230                                               SDP-0143
      TBLT  (42) =  1.260                                               SDP-0144
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      TBLT   (43) =   1.290                                                SDP-0145
      TBLT   (44) =   1.320                                                SDP-0146
      TBLT   (45) =   1.350                                                SDP-0147
      TBLT   (46) =   1.380                                                SDP-0148
      TBLT   (47) =   1.410                                                SDP-0149
      TBLT   (48) =   1.440                                                SDP-0150
      TBLT   (49) =   1.470                                                SDP-0151
      TBLT   (50) =   1.500                                                SDP-0152
      TBLT   (51) =   1.530                                                SDP-0153
      TBLT   (52) =   1.560                                                SDP-0154
      TBLT   (53) =   1.590                                                SDP-0155
      TBLT   (54) =   1.620                                                SDP-0156
      TBLT   (55) =   1.650                                                SDP-0157
      TBLT   (56) =   1.680                                                SDP-0158
      TBLT   (57) =   1.710                                                SDP-0159
      TBLT   (58) =   1.740                                                SDP-0160
      TBLT   (59) =   1.770                                                SDP-0161
      TBLT   (60) =   1.800                                                SDP-0162
      TBLT   (61) =   1.830                                                SDP-0163
      TBLT   (62) =   1.860                                                SDP-0164
      TBLT   (63) =   1.890                                                SDP-0165
      TBLT   (64) =   1.920                                                SDP-0166
      TBLT   (65) =   1.950                                                SDP-0167
      TBLT   (66) =   1.980                                                SDP-0168
      TBLT   (67) =   2.010                                                SDP-0169
      TBLT   (68) =   2.040                                                SDP-0170
      TBLT   (69) =   2.070                                                SDP-0171
      TBLT   (70) =   2.100                                                SDP-0172
      TBLT   (71) =   2.130                                                SDP-0173
      TBLT   (72) =   2.160                                                SDP-0174
      TBLT   (73) =   2.190                                                SDP-0175
      TBLT   (74) =   2.220                                                SDP-0176
      TBLT   (75) =   2.250                                                SDP-0177
      TBLT   (76) =   2.280                                                SDP-0178
      TBLT   (77) =   2.310                                                SDP-0179
      TBLT   (78) =   2.340                                                SDP-0180
      TBLT   (79) =   2.370                                                SDP-0181
      TBLT   (80) =   2.410                                                SDP-0182
      TBLT   (81) =   2.460                                                SDP-0183
      TBLT   (82) =   2.510                                                SDP-0184
      TBLT   (83) =   2.650                                                SDP-0185
      TBLT   (84) =   2.750                                                SDP-0186
      TBLT   (85) =   2.880                                                SDP-0187
      TBLT   (86) =   3.080                                                SDP-0188
      TBLT   (87) =   4.090                                                SDP-0189
C                                                                          SDP-0190
CC    TABLE FOR FOLK AND WARD CONSTANTS                                    SDP-0191
C                                                                          SDP-0192
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      TLFD   (01) = 00.00                                               SDP-0193
      TLFD   (02) = 00.35                                               SDP-0194
      TLFD   (03) = 00.50                                               SDP-0195
      TLFD   (04) = 01.00                                               SDP-0196
      TLFD   (05) = 02.00                                               SDP-0197
      TLFD   (06) = 04.00                                               SDP-0198
      TLFD   (07) = 99.99                                               SDP-0199
C                                                                       SDP-0200
      ITLFDC(01) = 0                                                    SDP-0201
      ITLFDC(02) = 1                                                    SDP-0202
      ITLFDC(03) = 2                                                    SDP-0203
      ITLFDC(04) = 3                                                    SDP-0204
      ITLFDC(05) = 4                                                    SDP-0205
      ITLFDC(06) = 5                                                    SDP-0206
      ITLFDC(07) = 6                                                    SDP-0207
C                                                                       SDP-0208
C                                                                       SDP-0209
      TLFS   (01) = -3.00                                               SDP-0210
      TLFS   (02) = -0.30                                               SDP-0211
      TLFS   (03) = -0.10                                               SDP-0212
      TLFS   (04) =  0.10                                               SDP-0213
      TLFS   (05) =  0.30                                               SDP-0214
      TLFS   (06) =  9.99                                               SDP-0215
C                                                                       SDP-0216
C                                                                       SDP-0217
      ITLFSC(01) = 1                                                    SDP-0218
      ITLFSC(02) = 1                                                    SDP-0219
      ITLFSC(03) = 2                                                    SDP-0220
      ITLFSC(04) = 3                                                    SDP-0221
      ITLFSC(05) = 4                                                    SDP-0222
      ITLFSC(06) = 5                                                    SDP-0223
C                                                                       SDP-0224
C                                                                       SDP-0225
      TLFK   (01) = 00.00                                               SDP-0226
      TLFK   (02) =  0.90                                               SDP-0227
      TLFK   (03) =  1.11                                               SDP-0228
      TLFK   (04) =  1.50                                               SDP-0229
      TLFK   (05) =  3.00                                               SDP-0230
      TLFK   (06) = 99.99                                               SDP-0231
C                                                                       SDP-0232
C                                                                       SDP-0233
      ITLFKC(01) = 0                                                    SDP-0234
      ITLFKC(02) = 1                                                    SDP-0235
      ITLFKC(03) = 2                                                    SDP-0236
      ITLFKC(04) = 3                                                    SDP-0237
      ITLFKC(05) = 4                                                    SDP-0238
      ITLFKC(06) = 5                                                    SDP-0239
C                                                                       SDP-0240
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C       END OF TABLES                                                          SDP-0241
C                                                                              SDP-0242
        ITR = 5                                                                SDP-0243
        ITW = 6                                                                SDP-0244
        TO = TIMEF(X)                                                          SDP-0245
C                                                                              SDP-0246
        KKK = 0                                                                SDP-0247
        MAT = 0                                                                SDP-0248
        MBT = 0                                                                SDP-0249
        MED = 0                                                                SDP-0250
        KSM = 0                                                                SDP-0251
C                                                                              SDP-0252
        ASSIGN 35 TO NC                                                        SDP-0253
        GO TO 900                                                              SDP-0254
C                                                                              SDP-0255
  1     READ INPUT TAPE ITR, 850, CRUZR, STATR, SMPLR, EXID, MO, DA, YR,       SDP-0256
       1LATA, LATB, LATC, LNGA, LNGB, LNGC, IQUD, ITYP, DEPTHR, PHIR,          SDP-0257
       2PRCTR, FRWTR, PAWTR, FRTH, PATH, CRLN, END                             SDP-0258
C                                                                              SDP-0259
C                                                                              SDP-0260
        FRWTR = FRWTR + (FRTH * 100.)                                          SDP-0261
        PAWTR = PAWTR + (PATH * 100.)                                          SDP-0262
        PHIR = (BTSNUF (PHIR)) * .001                                          SDP-0263
C                                                                              SDP-0264
  2     GO TO NA, (4,30)                                                       SDP-0265
  4     IF (ITYP) 5, 5, 6                                                      SDP-0266
  5     ASSIGN 1 TO NB                                                         SDP-0267
        ASSIGN 30 TO NA                                                        SDP-0268
        GO TO 7                                                                SDP-0269
  6     ASSIGN 35 TO NB                                                        SDP-0270
        ASSIGN 30 TO NA                                                        SDP-0271
C                                                                              SDP-0272
C                                                                              SDP-0273
C       HEADER PREPARATION                                                     SDP-0274
C                                                                              SDP-0275
  7     IF (IQUD -2) 8, 9, 11                                                  SDP-0276
  8     IDH = LNGA + 100                                                       SDP-0277
        GO TO 10                                                               SDP-0278
  9     IDH = LNGA                                                             SDP-0279
  10    CONTINUE                                                               SDP-0280
B       DG = 450000000000                                                      SDP-0281
B       DK = 660000000000                                                      SDP-0282
        GO TO 23                                                               SDP-0283
  11    IF (IQUD - 4) 12,13, 15                                                SDP-0284
  12    IDH = LNGA + 100                                                       SDP-0285
        GO TO 14                                                               SDP-0286
  13    IDH = LNGA                                                             SDP-0287
  14    CONTINUE                                                               SDP-0288
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B       DG = 620000000000                                                       SDP-0289
B       DK = 660000000000                                                       SDP-0290
        GO TO 23                                                                SDP-0291
 15     IF (IQUD - 6) 16, 17, 19                                                SDP-0292
 16     IDH = LNGA                                                              SDP-0293
        GO TO 18                                                                SDP-0294
 17     IDH = LNGA + 100                                                        SDP-0295
 18     CONTINUE                                                                SDP-0296
B       DG = 450000000000                                                       SDP-0297
B       DK = 250000000000                                                       SDP-0298
        GO TO 23                                                                SDP-0299
 19     IF (IQUD - 8) 20, 21, 21                                                SDP-0300
 20     IDH = LNGA                                                              SDP-0301
        GO TO 22                                                                SDP-0302
 21     IDH = LNGA + 100                                                        SDP-0303
 22     CONTINUE                                                                SDP-0304
B       DG = 620000000000                                                       SDP-0305
B       DK = 250000000000                                                       SDP-0306
C                                                                               SDP-0307
 23     CRUZ = CRUZR                                                            SDP-0308
        STAT = STATR                                                            SDP-0309
        EXC    = EXID                                                           SDP-0310
        DPTH = DEPTHR                                                           SDP-0311
        PAWT = PAWTR                                                            SDP-0312
C                                                                               SDP-0313
 24     WRITE OUTPUT TAPE ITW, 801, CRUZ, STAT, EXC, SMPLR, MO, DA, YR,         SDP-0314
     1LATA, LATB, LATC,  DG, IDH, LNGB, LNGC,  DK, DEPTHR, CRLN                 SDP-0315
C                                                                               SDP-0316
 25     GO TO NB, (1 ,35)                                                       SDP-0317
C                                                                               SDP-0318
B 30    IF (EXORF(STATR,STAT)) 100,31,100                                       SDP-0319
 31     IF (DPTH - DEPTHR)100, 32, 100                                          SDP-0320
B 32    IF (EXORF(EXC,EXID)) 100,33,100                                         SDP-0321
B 33    IF (EXORF(CRUZR,CRUZ)) 100,34,100                                       SDP-0322
C                                                                               SDP-0323
 34     GO TO NC, (35 ,50)                                                      SDP-0324
C                                                                               SDP-0325
 35     KK = 1                                                                  SDP-0326
        K  = 2                                                                  SDP-0327
C                                                                               SDP-0328
C       CHECK IF FRACTION PERCENTAGE AND FRACTION WEIGHT ON FIRST CARD          SDP-0329
C       OF EACH SAMPLE IS ZERO. IF NOT PREPARE ERROR STATEMENT NO.1990.         SDP-0330
C                                                                               SDP-0331
 36     IF (PRCTR) 38, 37, 38                                                   SDP-0332
 37     IF (FRWTR) 38, 39, 38                                                   SDP-0333
C                                                                               SDP-0334
  38    ASSIGN 1990 TO N2                                                       SDP-0335
        PHI (K) = -12.00                                                        SDP-0336
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      GO TO 40                                                                  SDP-0337
 39   PHI (K) = PHIR                                                            SDP-0338
 40   PHIA = PHIR                                                               SDP-0339
      PRCT (K) = PRCTR                                                          SDP-0340
      ACPC (K) = 0.0                                                            SDP-0341
      T(K) = -4.090                                                             SDP-0342
      FRWT(K) = FRWTR                                                           SDP-0343
      SUMPC  = 0.0                                                              SDP-0344
      SUMWT  = 0.0                                                              SDP-0345
 41   ASSIGN 50 TO NC                                                           SDP-0346
 42   GO TO 1                                                                   SDP-0347
 50   KK = KK + 1                                                               SDP-0348
      K = K + 1                                                                 SDP-0349
      PHI (K) = PHIR                                                            SDP-0350
      IF (FRWTR) 52, 53, 52                                                     SDP-0351
 52   PRCTR = (FRWTR / PAWT) * 100.0                                            SDP-0352
      SUMWT = SUMWT + FRWTR                                                     SDP-0353
 53   PRCT (K) = PRCTR                                                          SDP-0354
      SUMPC = SUMPC + PRCTR                                                     SDP-0355
      ACPC (K) = SUMPC                                                          SDP-0356
      FRWT(K) = FRWTR                                                           SDP-0357
C                                                                               SDP-0358
C     CALCULATE  T-VALUE                                                        SDP-0359
C                                                                               SDP-0360
C     IF SUMPC EQUALS OR LARGER THAN 100 SET  T TO 4.090                        SDP-0361
C                                                                               SDP-0362
 60   IF (SUMPC - 100.0) 62, 61, 61                                             SDP-0363
 61   T (K) = 4.090                                                             SDP-0364
      GO TO 77                                                                  SDP-0365
C                                                                               SDP-0366
 62   DLPC = SUMPC - 50.0                                                       SDP-0367
      IF (DLPC) 64, 63, 65                                                      SDP-0368
 63   T (K) = 0.0                                                               SDP-0369
      GO TO 77                                                                  SDP-0370
C                                                                               SDP-0371
 64   GMPC = -DLPC                                                              SDP-0372
      GO TO 66                                                                  SDP-0373
 65   GMPC = DLPC                                                               SDP-0374
 66   DO 69  L = 1, 100                                                         SDP-0375
      IF (TBLPC (L) - GMPC) 69, 70, 71                                          SDP-0376
 69   CONTINUE                                                                  SDP-0377
 70   TCALC = TBLT (L)                                                          SDP-0378
      GO TO 72                                                                  SDP-0379
 71   TCALC =   (GMPC - TBLPC (L-1))*(TBLT (L) - TBLT (L-1))/(TBLPC (L)        SDP-0380
     2 - TBLPC (L-1))  + TBLT (L- 1)                                            SDP-0381
      IF (TCALC - 4.090) 72,72,61                                               SDP-0382
 72   IF (DLPC) 73, 74, 74                                                      SDP-0383
 73   TCALC = -TCALC                                                            SDP-0384
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 74    T (K) = TCALC                                                          SDP-0385
                                                                              SDP-0386
C                                                                             SDP-0387
C                                                                             SDP-0388
C     CHECK FOR INCORRECT ORDER OF PHI SIZE.                                  SDP-0389
C                                                                             SDP-0390
 75    IF (PHIA - PHIR) 77, 76, 76                                            SDP-0391
 76    ASSIGN 1666 TO N2                                                      SDP-0392
 77    PHIA = PHIR                                                            SDP-0393
       GO TO 1                                                                SDP-0394
C                                                                             SDP-0395
C     LAST DETAIL CARD READ SO BEGIN CALCULATIONS                             SDP-0396
C                                                                             SDP-0397
C     SUMPC MUST BE BETWEEN 99.94 AND 100.06 OR SAMPLE IS REJECTED.           SDP-0398
C                                                                             SDP-0399
C                                                                             SDP-0400
  100 IF(SUMPC-99.94)1500,101,101                                             SDP-0401
  101 IF(SUMPC-100.06)102,102,1500                                            SDP-0402
  102 GO TO N2,(103,1666,1990)                                                SDP-0403
C                                                                             SDP-0404
C     1500 MEANS ACCUMULATED PERCENT NOT WITHIN 0.06 OF 100 PERCENT           SDP-0405
C                                                                             SDP-0406
 103  WRITE OUTPUT TAPE ITW, 802                                             SDP-0407
       KJK = KK + 1                                                           SDP-0408
       WRITE OUTPUT TAPE ITW, 8022, ((PHI(J), PRCT(J), ACPC(J)), J=2,KJK)     SDP-0409
C                                                                             SDP-0410
       SUMNL = ACPC (KK)                                                      SDP-0411
C                                                                             SDP-0412
C     IF SUMNL IS LESS THAN 72.00, BY-PASS ALL CALCULATIONS EXCEPT            SDP-0413
C     SANS-SILT-CLAY RELATIONSHIP.                                            SDP-0414
C                                                                             SDP-0415
C                                                                             SDP-0416
       IF (SUMNL - 72.00) 104, 105, 105                                       SDP-0417
 104   ASSIGN  392 TO NSSC                                                    SDP-0418
       WRITE OUTPUT TAPE ITW, 809, PHI(KK)                                    SDP-0419
       GO TO  300                                                             SDP-0420
 105   IF (4 - KK) 111, 106, 106                                              SDP-0421
C                                                                             SDP-0422
C                                                                             SDP-0423
 106   WRITE OUTPUT TAPE ITW, 815, KK                                         SDP-0424
       GO TO 901                                                              SDP-0425
C                                                                             SDP-0426
C     PREPARE TO INTERPOLATE PHI AT THE 5 PERCENT LEVEL                       SDP-0427
C                                                                             SDP-0428
 111   ASSIGN 1105 TO NINT                                                    SDP-0429
       XPC = 5.00                                                             SDP-0430
       XT  = -1.645                                                           SDP-0431
       METAA= 10                                                              SDP-0432
       METBB = 20
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      META = 0                                                          SDP-0433
      METB = 0                                                          SDP-0434
      GO TO 150                                                         SDP-0435
C                                                                       SDP-0436
 1105 PHI5 = YY                                                         SDP-0437
C                                                                       SDP-0438
C     PREPARE TO INTERPOLATE PHI AT THE  16 PERCENT LEVEL               SDP-0439
C                                                                       SDP-0440
  112 ASSIGN 1116 TO NINT                                               SDP-0441
      XPC = 16.00                                                       SDP-0442
      XT  = -.995                                                       SDP-0443
      METAA=  1                                                         SDP-0444
      METBB=  2                                                         SDP-0445
      GO TO 150                                                         SDP-0446
C                                                                       SDP-0447
 1116 PHI16 = YY                                                        SDP-0448
C                                                                       SDP-0449
C     PREPARE TO INTERPOLATE PHI AT THE  25 PERCENT LEVEL               SDP-0450
C                                                                       SDP-0451
  113 ASSIGN 1125 TO NINT                                               SDP-0452
      XPC = 25.00                                                       SDP-0453
      XT  = -.674                                                       SDP-0454
      METAA = 0                                                         SDP-0455
      METBB = 0                                                         SDP-0456
      META = 10000                                                      SDP-0457
      METB = 20000                                                      SDP-0458
      GO TO 150                                                         SDP-0459
C                                                                       SDP-0460
 1125 PHI25 = YY                                                        SDP-0461
C                                                                       SDP-0462
C     PREPARE TO INTERPOLATE PHI AT THE  50 PERCENT LEVEL               SDP-0463
C                                                                       SDP-0464
  114 ASSIGN 1150 TO NINT                                               SDP-0465
      XPC = 50.00                                                       SDP-0466
      XT  = 00.00                                                       SDP-0467
      META = 1000                                                       SDP-0468
      METB = 2000                                                       SDP-0469
      GO TO 150                                                         SDP-0470
C                                                                       SDP-0471
 1150 PHI50 = YY                                                        SDP-0472
C                                                                       SDP-0473
C     PREPARE TO INTERPOLATE PHI AT THE 75 PERCENT LEVEL                SDP-0474
C                                                                       SDP-0475
  115 ASSIGN 1175 TO NINT                                               SDP-0476
      XPC = 75.00                                                       SDP-0477
      XT  = .674                                                        SDP-0478
      META = 100                                                        SDP-0479
      METB = 200                                                        SDP-0480
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      GO TO 150                                                          SDP-0481
C                                                                        SDP-0482
 1175 PH175 = YY                                                         SDP-0483
C                                                                        SDP-0484
C     PREPARE TO INTERPOLATE PHI AT THE 84 PERCENT LEVEL                 SDP-0485
C                                                                        SDP-0486
  116 ASSIGN 1184 TO NINT                                                SDP-0487
      XPC = 84.00                                                        SDP-0488
      XT  =  .995                                                        SDP-0489
      META = 10                                                          SDP-0490
      METB = 20                                                          SDP-0491
      GO TO 150                                                          SDP-0492
C                                                                        SDP-0493
 1184 PH184 = YY                                                         SDP-0494
C                                                                        SDP-0495
C     PREPARE TO INTERPOLATE PHI AT THE 95 PERCENT LEVEL                 SDP-0496
C                                                                        SDP-0497
      ASSIGN 1195 TO NINT                                                SDP-0498
      XPC = 95.00                                                        SDP-0499
      XT  = 1.645                                                        SDP-0500
      META = 1                                                           SDP-0501
      METB = 2                                                           SDP-0502
      GO TO 150                                                          SDP-0503
C                                                                        SDP-0504
 1195 PH195 = YY                                                         SDP-0505
C                                                                        SDP-0506
  118 WRITE OUTPUT TAPE ITW, 803, PHI5 , PHI16, PHI25, PHI50, PHI75,     SDP-0507
     1 PHI84, PH195, METT, MET                                           SDP-0508
      GO TO 300                                                          SDP-0509
C                                                                        SDP-0510
C     BEFORE THIS POINT IF ACNL LESS THAN 72, SAMPLE HAS BEEN REJECTED   SDP-0511
C     BEFORE INTERPOLATION                                               SDP-0512
C     FIND PERCENT JUST LARGER THAN PERCENT LEVEL IN QUESTION            SDP-0513
C                                                                        SDP-0514
  150 DO 151  L = 1, 100                                                 SDP-0515
C                                                                        SDP-0516
      IF (ACPC(L) - XPC) 151, 152, 153                                   SDP-0517
  151 CONTINUE                                                           SDP-0518
C                                                                        SDP-0519
  152 YY = PHI (L)                                                       SDP-0520
      GO TO 210                                                          SDP-0521
C                                                                        SDP-0522
  153 IF(XPC-75.00)154,155,157                                           SDP-0523
  154  IF(3-L)195,196,196                                                SDP-0524
C                                                                        SDP-0525
  155  IF(SUMNL-75.00)167,156,156                                        SDP-0526
  156  IF(L-KK)195,195,196                                               SDP-0527
C                                                                        SDP-0528
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  157   IF(XPC-84.00)158,158,159                                          SDP-0529
  158   IF(SUMNL-84.00)168,156,156                                        SDP-0530
C                                                                        SDP-0531
  159   IF(SUMNL-95.00)169,156,156                                        SDP-0532
C                                                                        SDP-0533
C                                                                        SDP-0534
C     PREPARE TO EXTRAPOLATE  PHI AT THE  75 PERCENT LEVEL               SDP-0535
C                                                                        SDP-0536
 167  ASSIGN 1275 TO NINT                                               SDP-0537
      XT = 0.674                                                        SDP-0538
      META = 300                                                        SDP-0539
      METB = 400                                                        SDP-0540
      GO TO 197                                                         SDP-0541
C                                                                        SDP-0542
 1275 PHI75 = YY                                                        SDP-0543
      WRITE OUTPUT TAPE ITW, 8031, PHI5 , PHI16, PHI25, PHI50, PHI75,   SDP-0544
     1 METT,MET                                                         SDP-0545
      ASSIGN 615 TO NFAW                                                SDP-0546
      GO TO 300                                                         SDP-0547
C                                                                        SDP-0548
C     PREPARE TO EXTRAPOLATE PHI AT 84 PERCENT LEVEL                     SDP-0549
C                                                                        SDP-0550
 168  IF (SUMNL - 81.00) 171, 172, 172                                  SDP-0551
C                                                                        SDP-0552
 171  ASSIGN  505 TO NINM                                               SDP-0553
      WRITE OUTPUT TAPE ITW, 8031, PHI5 , PHI16, PHI25, PHI50, PHI75,   SDP-0554
     1 METT,MET                                                         SDP-0555
      GO TO 300                                                         SDP-0556
C                                                                        SDP-0557
 172  ASSIGN 1284 TO NINT                                               SDP-0558
      XT = 0.995                                                        SDP-0559
      META = 30                                                         SDP-0560
      METB = 40                                                         SDP-0561
      GO TO 197                                                         SDP-0562
C                                                                        SDP-0563
 1284 PHI84 = YY                                                        SDP-0564
      WRITE OUTPUT TAPE ITW, 8032, PHI5 , PHI16, PHI25, PHI50, PHI75,   SDP-0565
     1 PHI84, METT, MET                                                 SDP-0566
      ASSIGN 615 TO NFAW                                                SDP-0567
      GO TO 300                                                         SDP-0568
C                                                                        SDP-0569
C     PREPARE TO EXTRAPOLATE PHI AT THE  95 PERCENT LEVEL                SDP-0570
C                                                                        SDP-0571
 169  IF (SUMNL - 92.00) 174, 175, 175                                  SDP-0572
C                                                                        SDP-0573
 174  ASSIGN  615 TO NFAW                                               SDP-0574
      WRITE OUTPUT TAPE ITW, 8032, PHI5 , PHI16, PHI25, PHI50, PHI75,   SDP-0575
     1 PHI84, METT,MET                                                  SDP-0576
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      GO TO 300                                                                 SDP-0577
C                                                                               SDP-0578
 175  ASSIGN 1295 TO NINT                                                       SDP-0579
      XT = 1.645                                                                SDP-0580
      META = 3                                                                  SDP-0581
      METB = 4                                                                  SDP-0582
      GO TO  197                                                                SDP-0583
C                                                                               SDP-0584
 1295 PHI95 =YY                                                                 SDP-0585
      WRITE OUTPUT TAPE ITW, 8033, PHI5 , PHI16, PHI25, PHI50, PHI75,           SDP-0586
     1    PHI84, PHI95, METT,MET                                               SDP-0587
      GO TO 300                                                                 SDP-0588
C                                                                               SDP-0589
 195  X1 = T (L-2)                                                              SDP-0590
      X2 = T (L-1)                                                              SDP-0591
      X3 = T (L)                                                                SDP-0592
      X4 = T (L+1)                                                              SDP-0593
      Y1 = PHI (L-2)                                                            SDP-0594
      Y2 = PHI (L-1)                                                            SDP-0595
      Y3 = PHI (L)                                                              SDP-0596
      Y4 = PHI (L+1)                                                            SDP-0597
      LMT=22                                                                    SDP-0598
      GO TO 199                                                                 SDP-0599
C                                                                               SDP-0600
 196  X1 = T (L-1)                                                              SDP-0601
      X2 = T (L)                                                                SDP-0602
      X3 = T (L+1)                                                              SDP-0603
      X4 = T (L+2)                                                              SDP-0604
      Y1 = PHI (L-1)                                                            SDP-0605
      Y2 = PHI (L)                                                              SDP-0606
      Y3 = PHI (L+1)                                                            SDP-0607
      Y4 = PHI (L+2)                                                            SDP-0608
      LMT=13                                                                    SDP-0609
      GO TO 199                                                                 SDP-0610
C                                                                               SDP-0611
 197  X1 = T (L-3)                                                              SDP-0612
      X2 = T (L-2)                                                              SDP-0613
      X3 = T (L-1)                                                              SDP-0614
      X4 = T (L)                                                                SDP-0615
      Y1 = PHI (L-3)                                                            SDP-0616
      Y2 = PHI (L-2)                                                            SDP-0617
      Y3 = PHI (L-1)                                                            SDP-0618
      Y4 = PHI (L)                                                              SDP-0619
      LMT=31                                                                    SDP-0620
C                                                                               SDP-0621
 199  X11 = T (L -1)                                                            SDP-0622
      X22 = T (L)                                                               SDP-0623
      Y11 = PHI (L-1)                                                           SDP-0624
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      Y22 = PHI (L)                                                              SDP-0625
C                                                                                SDP-0626
      X = XT                                                                     SDP-0627
C                                                                                SDP-0628
C     AITKENS FOUR POINT INTERPOLATION                                           SDP-0629
C                                                                                SDP-0630
 200  P12 =    ( (Y1 * (X2 - X)) - (Y2 * (X1 -X)))/(X2 - X1)                     SDP-0631
      P13 =    ( (Y1 * (X3 - X)) - (Y3 * (X1 -X)))/(X3 - X1)                     SDP-0632
      P14 =    ( (Y1 * (X4 - X)) - (Y4 * (X1 -X)))/(X4 - X1)                     SDP-0633
C                                                                                SDP-0634
      P123 = ((P12 * (X3 - X)) - (P13 * (X2 - X)))/(X3 - X2)                     SDP-0635
      P124 = ((P12 * (X4 - X)) - (P14 * (X2 - X)))/(X4 - X2)                     SDP-0636
C                                                                                SDP-0637
      YYA =  ((P123 * (X4 -X)) - (P124 * (X3 - X)))/(X4 - X3)                    SDP-0638
C                                                                                SDP-0639
C     LINEAR INTERPOLATION                                                       SDP-0640
C                                                                                SDP-0641
 201  YYL =    (X - X11) * (Y22 - Y11) / (X22 - X11)    + Y11                    SDP-0642
C                                                                                SDP-0643
      YYT =  YYA - YYL                                                           SDP-0644
      IF(YYT) 202, 206, 203                                                      SDP-0645
 202  YYT = -YYT                                                                 SDP-0646
 203  IF (YYT - 0.20) 204, 204,207                                               SDP-0647
 204  IF (YYA - Y22) 205, 207, 207                                               SDP-0648
 205  IF (Y11 - YYA) 206, 207, 207                                               SDP-0649
 206  YY = YYA                                                                   SDP-0650
      METT= METT+ METAA                                                          SDP-0651
      MET = MET + META                                                           SDP-0652
      GO TO 210                                                                  SDP-0653
 207  YY = YYL                                                                   SDP-0654
      METT= METT+ METBB                                                          SDP-0655
      MET = MET + METB                                                           SDP-0656
C                                                                                SDP-0657
 210  GO TO NINT, (1105,1116,1125,1150,1175,1184,1195,1275,1284,1295)            SDP-0658
C                                                                                SDP-0659
C     CALCULATE SAND, SILT, CLAY RELATIONSHIPS                                   SDP-0660
C                                                                                SDP-0661
 300  IF (PHI( KJK   ) - (-1.0)) 305, 301, 301                                   SDP-0662
 301  DO 302 KG = 2, KJK                                                         SDP-0663
      IF (ABSF(PHI(KG) - (-1.0)) - .0001) 303, 303, 3022                         SDP-0664
 3022 IF (PHI(KG) - (-1.0)) 302, 303, 304                                        SDP-0665
 302  CONTINUE                                                                   SDP-0666
 303  GRSN = ACPC(KG)                                                            SDP-0667
      GO TO 307                                                                  SDP-0668
 304  GRSN = 0.0                                                                 SDP-0669
      RATIO = 9999.99                                                            SDP-0670
      GO TO 307                                                                  SDP-0671
 305  SAND = 0.0                                                                 SDP-0672
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      SILT = 0.0                                                        SDP-0673
      CLAY  = 0.0                                                       SDP-0674
      NCLAS = 1                                                         SDP-0675
      GO TO 380                                                         SDP-0676
C                                                                       SDP-0677
 307  IF (PHI( KJK  ) - 4.0) 312, 308, 308                             SDP-0678
 308  DO 309  KS = 2, KJK                                              SDP-0679
      IF (ABSF(PHI(KS) - 4.0) - .0001) 310, 310, 3099                   SDP-0680
 3099 IF (PHI(KS) - 4.0) 309, 310, 311                                  SDP-0681
 309  CONTINUE                                                          SDP-0682
 310  SAND = ACPC(KS)                                                   SDP-0683
      SANDP = SAND -  GRSN                                              SDP-0684
       FMUD = SUMPC - SAND                                              SDP-0685
      RATIO = SAND/FMUD                                                 SDP-0686
      GO TO 313                                                         SDP-0687
C                                                                       SDP-0688
 311  SAND = 0.0                                                        SDP-0689
      SANDP = 0.0                                                       SDP-0690
      RATIO = 9999.99                                                   SDP-0691
      GO TO 313                                                         SDP-0692
 312  SAND = SUMPC - GRSN                                               SDP-0693
      SANDP = SAND                                                      SDP-0694
      RATIO = 9999.99                                                   SDP-0695
      SILT  = 0.0                                                       SDP-0696
      CLAY = 0.0                                                        SDP-0697
      NCLAS = 1                                                         SDP-0698
      GO TO 380                                                         SDP-0699
C                                                                       SDP-0700
 0313 IF (ABSF(PHI(KJK) - 8.0) - .0001) 314, 314, 3177                  SDP-0701
 3177 IF (PHI( KJK  ) - 8.0) 317, 314, 314                              SDP-0702
 314  DO 315  KSL = 2, KJK                                              SDP-0703
      IF (ABSF(PHI(KSL) - 8.0) - .0001) 316, 316, 3155                  SDP-0704
 3155 IF (PHI(KSL) - 8.0) 315, 316, 316                                 SDP-0705
 315  CONTINUE                                                          SDP-0706
 316  SILT = ACPC(KSL) - SAND                                           SDP-0707
      CLAY = SUMPC - SAND - SILT                                        SDP-0708
      GO TO 320                                                         SDP-0709
 317  SILT = SUMPC - SAND                                               SDP-0710
      CLAY = 0.0                                                        SDP-0711
C                                                                       SDP-0712
C     DETERMINE POSITION OF SAMPLE IN SHEPPARD DIAGRAM.                 SDP-0713
C                                                                       SDP-0714
C                                                                       SDP-0715
 320  IF (SAND - 75.00) 322, 321, 321                                   SDP-0716
 321  NCLAS = 1                                                         SDP-0717
      GO TO 380                                                         SDP-0718
 322  IF (SILT - 75.00) 324, 323, 323                                   SDP-0719
 323  NCLAS = 4                                                         SDP-0720
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      GO TO 380                                                          SDP-0721
 324  IF (CLAY - 75.00) 326, 325, 325                                    SDP-0722
 325  NCLAS = 10                                                         SDP-0723
      GO TO 380                                                          SDP-0724
C                                                                        SDP-0725
 326  IF (SAND - 20.00) 330, 327, 327                                    SDP-0726
 327  IF (SILT - 20.00) 340, 328, 328                                    SDP-0727
 328  IF (CLAY - 20.00) 350, 329, 329                                    SDP-0728
 329  NCLAS = 6                                                          SDP-0729
      GO TO 380                                                          SDP-0730
C                                                                        SDP-0731
 330  IF (CLAY/SILT - 1.) 336, 331, 332                                  SDP-0732
 331  NCLASS = 1                                                         SDP-0733
 332  IF (SAND / SILT - 1.) 333, 334, 335                                SDP-0734
 333  NCLAS = 9                                                          SDP-0735
      GO TO 380                                                          SDP-0736
 334  NCLASS = 1                                                         SDP-0737
 335  NCLAS  = 8                                                         SDP-0738
      GO TO 380                                                          SDP-0739
C                                                                        SDP-0740
 336  IF (CLAY / SAND  - 1.) 337, 338, 339                               SDP-0741
 337  NCLAS = 3                                                          SDP-0742
      GO TO 380                                                          SDP-0743
 338  NCLASS = 1                                                         SDP-0744
      GO TO 380                                                          SDP-0745
 339  NCLAS = 7                                                          SDP-0746
      GO TO 380                                                          SDP-0747
C                                                                        SDP-0748
 340  IF (CLAY / SAND - 1.) 342, 341, 332                                SDP-0749
 341  NCLASS = 1                                                         SDP-0750
      GO TO 332                                                          SDP-0751
C                                                                        SDP-0752
 342  IF (CLAY / SILT - 1.) 343, 344, 345                                SDP-0753
 343  NCLAS = 2                                                          SDP-0754
      GO TO 380                                                          SDP-0755
 344  NCLASS = 1                                                         SDP-0756
      GO TO 380                                                          SDP-0757
 345  NCLAS = 5                                                          SDP-0758
      GO TO 380                                                          SDP-0759
C                                                                        SDP-0760
 350  IF (SAND / SILT - 1.) 336, 351, 342                                SDP-0761
 351  NCLASS = 1                                                         SDP-0762
      GO TO 342                                                          SDP-0763
C                                                                        SDP-0764
 380  WRITE OUTPUT TAPE ITW, 804                                         SDP-0765
 381  IF (RATIO - 9999.99) 382, 383, 382                                 SDP-0766
 382  IF (NCLASS) 385, 384, 385                                          SDP-0767
 383  IF (NCLAS) 386, 387, 386                                           SDP-0768
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C                                                                       SDP-0769
 384  WRITE OUTPUT TAPE ITW, 8041, GRSN, SANDP, SILT, CLAY, SUMPC,      SDP-0770
     1 RATIO, NCLAS                                                     SDP-0771
      GO TO 390                                                         SDP-0772
 385  WRITE OUTPUT TAPE ITW, 8042, GRSN, SANDP, SILT, CLAY, SUMPC,      SDP-0773
     1 RATIO, NCLAS,NCLASS                                              SDP-0774
      GO TO 390                                                         SDP-0775
 386  WRITE OUTPUT TAPE ITW, 8043, GRSN, SANDP, SILT, CLAY, SUMPC,      SDP-0776
     1 NCLAS                                                            SDP-0777
      GO TO 390                                                         SDP-0778
 387  WRITE OUTPUT TAPE ITW, 8044, GRSN, SANDP, SILT, CLAY, SUMPC,      SDP-0779
     1 NCLAS, NCLASS                                                    SDP-0780
 390  NCLASS = 0                                                        SDP-0781
 391  GO TO NSSC, (392, 400)                                            SDP-0782
 392  WRITE OUTPUT TAPE ITW, 8051                                       SDP-0783
      GO TO 700                                                         SDP-0784
C                                                                       SDP-0785
C     CALCULATE TRASK VALUES                                            SDP-0786
C                                                                       SDP-0787
D400  Q1 = 2.**(-PHI25)                                                 SDP-0788
D     Q2 = 2.**(-PHI50)                                                 SDP-0789
D     Q3 = 2.**(-PHI75)                                                 SDP-0790
C                                                                       SDP-0791
      SO =  SQRTF (Q1 / Q3)                                             SDP-0792
      FLGSO = LOG10F(SO)                                                SDP-0793
      SKG = SQRTF((Q1 * Q3)/(Q2 * Q2))                                  SDP-0794
C                                                                       SDP-0795
      WRITE OUTPUT TAPE ITW, 805, Q1, Q2, Q3, SO, FLGSO, SKG            SDP-0796
C                                                                       SDP-0797
 401  GO TO NTRSK, (500, 901)                                           SDP-0798
C                                                                       SDP-0799
C     CALCULATE INMAN VALUES                                            SDP-0800
C                                                                       SDP-0801
 500  GO TO NINM, (501, 505)                                            SDP-0802
 501  FIMD = (PHI16 + PHI84) / 2.0                                      SDP-0803
      FIDV = (PHI84 - PHI16) / 2.0                                      SDP-0804
      FISK = (FIMD - PHI50)/FIDV                                        SDP-0805
C                                                                       SDP-0806
 502  IF (PHI95 - 99.99) 503, 504, 503                                  SDP-0807
 503  F2SK =(((PHI95 + PHI5 )/ 2.0) - PHI50) / FIDV                     SDP-0808
      FIKU = (((PHI95 - PHI5 )/ 2.0) - FIDV) / FIDV                     SDP-0809
C                                                                       SDP-0810
      WRITE OUTPUT TAPE ITW, 806, PHI50, FIMD, FIDV, FISK, F2SK, FIKU   SDP-0811
      GO TO 600                                                         SDP-0812
C                                                                       SDP-0813
 504  WRITE OUTPUT TAPE ITW, 8061, PHI50, FIMD, FIDV, FISK              SDP-0814
      GO TO 600                                                         SDP-0815
C                                                                       SDP-0816
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 505  WRITE OUTPUT TAPE ITW, 8062                                                    SDP-0817
      GO TO 700                                                                      SDP-0818
C                                                                                    SDP-0819
C     CALCULATE FOLK AND WARD VALUES                                                 SDP-0820
C                                                                                    SDP-0821
 600  GO TO NFAW, (601, 615)                                                         SDP-0822
 601  FMZ = (PHI16 + PHI50 + PHI84) / 3.0                                            SDP-0823
 602  FDEV = (PHI84 - PHI16)/4.0 + (PHI95 - PHI5 )/6.6                               SDP-0824
 603  DO 604  L = 1, 7                                                              SDP-0825
      IF (TLFD(L) - FDEV) 604,605,605                                                SDP-0826
 604  CONTINUE                                                                       SDP-0827
 605  IFDTL = ITLFDC(L)                                                              SDP-0828
C                                                                                    SDP-0829
 606  FSK  =  (PHI16 + PHI84 -2.0 * PHI50)/(2.0 * (PHI84 - PHI16))  +               SDP-0830
     1 ((PHI5  + PHI95)-(2.0 * PHI50))/(2.0 * (PHI95 - PHI5 ))                       SDP-0831
 607  DO 608  L = 1, 7                                                              SDP-0832
      IF (TLFS(L) - FSK) 608,609,609                                                 SDP-0833
 608  CONTINUE                                                                       SDP-0834
 609  IFSKTL = ITLFSC(L)                                                             SDP-0835
C                                                                                    SDP-0836
 610  FKG = (PHI95 - PHI5 ) / (2.44 * (PHI75- PHI25))                                SDP-0837
 611  DO 612  L = 1, 7                                                              SDP-0838
      IF (TLFK(L) - FKG) 612,613,613                                                 SDP-0839
 612  CONTINUE                                                                       SDP-0840
 613  IFKTL = ITLFKC(L)                                                              SDP-0841
C                                                                                    SDP-0842
 614  WRITE OUTPUT TAPE ITW, 807, FMZ, FDEV,IFDTL, FSK,IFSKTL, FKG,IFKTL             SDP-0843
      GO TO 700                                                                      SDP-0844
C                                                                                    SDP-0845
 615  WRITE OUTPUT TAPE ITW, 8071                                                    SDP-0846
      GO TO 700                                                                      SDP-0847
 700  GO TO 901                                                                      SDP-0848
C                                                                                    SDP-0849
C     INITIALIZING BLOCK                                                             SDP-0850
C                                                                                    SDP-0851
 900  ASSIGN 1 TO NINOT                                                              SDP-0852
      ASSIGN 4 TO NA                                                                 SDP-0853
      GO TO 902                                                                      SDP-0854
C                                                                                    SDP-0855
 901  KKK = KKK + KK                                                                 SDP-0856
      KSM = KSM + 1                                                                  SDP-0857
C                                                                                    SDP-0858
      ASSIGN 2 TO NINOT                                                              SDP-0859
      IF (END - 99999.) 902, 950, 902                                                SDP-0860
 902  ASSIGN  103 TO N2                                                              SDP-0861
      ASSIGN 400 TO NSSC                                                             SDP-0862
      ASSIGN  500 TO NTRSK                                                           SDP-0863
      ASSIGN  501 TO NINM                                                            SDP-0864
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      ASSIGN  601 TO NFAW                                                    SDP-0865
      ASSIGN  901 TO NFINL                                                   SDP-0866
      ASSIGN 4 TO NA                                                         SDP-0867
      PHI(1)=-12.00                                                          SDP-0868
      PHI75 = 99.99                                                          SDP-0869
      PHI84 = 99.99                                                          SDP-0870
      PHI95 = 99.99                                                          SDP-0871
C                                                                            SDP-0872
      DO 903 K = 1, 100                                                      SDP-0873
      T(K) = 4.090                                                           SDP-0874
  904 ACPC(K) = 999.99                                                       SDP-0875
  903 PHI(K) = 99.99                                                         SDP-0876
C                                                                            SDP-0877
      NCLAS =0                                                               SDP-0878
      NCLASS=0                                                               SDP-0879
      MA = 0                                                                 SDP-0880
      MB = 0                                                                 SDP-0881
      MBT = 0                                                                SDP-0882
      MC = 0                                                                 SDP-0883
      MED = 0                                                                SDP-0884
      K = 0                                                                  SDP-0885
      KK = 0                                                                 SDP-0886
      ACPC(1) = 00.00                                                        SDP-0887
      MET = 0000000                                                          SDP-0888
      METT= 00                                                               SDP-0889
      GO TO NIMOT,(1,2)                                                      SDP-0890
C                                                                            SDP-0891
  950 WRITE OUTPUT TAPE ITW, 860, KSM, KKK                                   SDP-0892
C                                                                            SDP-0893
  951 IF (MBT) 952, 952, 954                                                 SDP-0894
  952 IF (MC) 956, 956, 955                                                  SDP-0895
C                                                                            SDP-0896
C                                                                            SDP-0897
  954 WRITE OUTPUT TAPE ITW, 863, (CRMB(L), STMB(L), EXMB(L), L = 1,MBT)     SDP-0898
      GO TO 952                                                              SDP-0899
C                                                                            SDP-0900
  955 WRITE OUTPUT TAPE ITW, 864, (CRMC(L), STMC(L), EXMC(L), L = 1,MC)      SDP-0901
C                                                                            SDP-0902
  956 MTT = MBT + MC + MED                                                   SDP-0903
      IF (MTT) 958, 958, 959                                                 SDP-0904
C                                                                            SDP-0905
  958 WRITE OUTPUT TAPE ITW, 861                                             SDP-0906
      GO TO 960                                                              SDP-0907
  959 WRITE OUTPUT TAPE ITW, 865, MTT                                        SDP-0908
  960 TIMY = TIMEF(X) - TO                                                   SDP-0909
      WRITE OUTPUT TAPE 6, 7333, TIMY                                        SDP-0910
 7333 FORMAT(1H1, F10.3)                                                     SDP-0911
      CALL EXIT                                                              SDP-0912
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C                                                                               SDP-0913
 1500 WRITE OUTPUT TAPE ITW, 830, PAWT                                          SDP-0914
C                                                                               SDP-0915
      KJK = KK + 1                                                              SDP-0916
C                                                                               SDP-0917
 1501 WRITE OUTPUT TAPE ITW, 831                                                SDP-0918
      WRITE OUTPUT TAPE ITW, 833, (PHI(J), FRWT(J), PRCT(J), ACPC(J),           SDP-0919
     1 T(J), J = 2, KJK)                                                        SDP-0920
 1503 WRITE OUTPUT TAPE ITW, 8333, SUMWT                                        SDP-0921
 1504 MED = MED + 1                                                             SDP-0922
 8333 FORMAT (1H0,29X,24HSUM FRACTION WEIGHTS =    F8.3,6H GRAMS    )          SDP-0923
      GO TO 901                                                                 SDP-0924
C                                                                               SDP-0925
 1666 WRITE OUTPUT TAPE ITW, 8666                                               SDP-0926
      CRMB(MBT) = CRUZ                                                          SDP-0927
      STMB(MBT) = STAT                                                          SDP-0928
      EXMB(MBT) = EXC                                                           SDP-0929
      GO TO 1501                                                                SDP-0930
 8666 FORMAT (1H0 28X, 40H CARDS OUT OF ORDER. CHECK VALUES BELOW.     )        SDP-0931
 1990 WRITE OUTPUT TAPE ITW, 8990                                               SDP-0932
      CRMC(MC) = CRUZ                                                           SDP-0933
      STMB(MC) = STAT                                                           SDP-0934
      EXMC(MC) = EXC                                                            SDP-0935
      GO TO 1501                                                                SDP-0936
 8990 FORMAT (1H0 28X, 36HNO ZERO PERCENT CARD. WHERE IS IT.         /          SDP-0937
     1 29X, 20H CHECK VALUES BELOW.                )                            SDP-0938
C                                                                               SDP-0939
C     LIST OF FORMAT STATEMENTS                                                 SDP-0940
C                                                                               SDP-0941
 801  FORMAT (1H1, 37X, 8H CRUISE , A5, 3X, 9H STATION , A3,  9H    EX IDSDP-0942
     1 , A2 // 29X, 14H SAMPLER TYPE , A2,  7H  DATE , A2, 1H/, A2, 1H/,SDP-0943
     2 A2,          7H  LAT. , I2, 1H-, I2, 1H., I1, A1, 9H  LONG. ,I3,SDP-0944
     3     1H-, I2, 1H., I1, A1 /  29X, 24H DEPTH FROM TOP OF CORE ,F5.0SDP-0945
     4,5H MM. , 16H LENGTH OF CORE ,F5.0, 5H MM.  )                             SDP-0946
 802  FORMAT (1H0, 48X, 28H PHI   FRACTION  ACCUMULATED  /                      SDP-0947
     1              49X, 28H SIZE   PERCENT    PERCENT   // )                   SDP-0948
 8022 FORMAT (      48X,    F6.2,    F8.2,      F12.2)                         SDP-0949
 803  FORMAT (1H0, 28X, 31H PHI SIZES AT PERCENT LEVEL OF   33X,  7H METSDP-0950
     1HOD / 29X, 71H   5         16         25         50         75        84  SDP-0951
     2     95       USED // 30X, F5.2, 6F9.2, 4X, I2, I5)                      SDP-0952
 8031 FORMAT (1H0, 28X, 71H PHI SIZES AT PERCENT LEVEL OF    (75 LEVEL EXSDP-0953
     2TRAPOLATED)        METHOD  /29X,70H   5         16         25         5SDP-0954
     30        75                        USED //30X, F5.2, 4F9.2,14X, I2SDP-0955
     4, I5)                                                                     SDP-0956
C                                                                               SDP-0957
 8032 FORMAT (1H0, 28X, 71H PHI SIZES AT PERCENT LEVEL OF    (84 LEVEL EXSDP-0958
     2TRAPOLATED)        METHOD  /29X,71H   5         16         25         5SDP-0959
     30        75        84              USED //30X, F5.2, 5F9.2, 4X, I2SDP-0960
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     4, I5)                                                                    SDP-0961
C                                                                              SDP-0962
 8033 FORMAT (1H0, 28X, 71H PHI SIZES AT PERCENT LEVEL OF    (95 LEVEL EXSDP-0963
     2TRAPOLATED)          METHOD  /29X,70H   5          16          25      5SDP-0964
     30         75        84        95         USED //30X, F5.2, 6F9.2, 4X, I2SDP-0965
     4, I5)                                                                    SDP-0966
 804  FORMAT (1H0, 28X, 32H SAND, SILT, CLAY RELATIONSHIPS  /                  SDP-0967
     2              30X, 66H  GRAVEL      SAND      SILT      CLAY     TOTAL  SDP-0968
     3  SAND/MUD    CLASS       )                                              SDP-0969
C                                                                              SDP-0970
 8041 FORMAT (1H0, 29X, F8.2, 5F 9.2, 8X, I1, I4)                             SDP-0971
C                                                                              SDP-0972
 8042 FORMAT (1H0, 29X, F8.2, 5F 9.2, 8X, I1, 1X, I1, I4)                     SDP-0973
C                                                                              SDP-0974
 8043 FORMAT (1H0, 29X, F8.2, 4F 9.2, 14X, I1, I4)                            SDP-0975
C                                                                              SDP-0976
 8044 FORMAT (1H0, 28X, F8.2, 4F 9.2, 14X, I1, 1X, I1, I4)                    SDP-0977
C                                                                              SDP-0978
 805  FORMAT (1H0, 28X, 13H TRASK VALUES / 29X, 51H    Q1         Q2          SDP-0979
     1Q3         SO      LOG SO      SKG // 30X,  F6.3, 4F9.3, F8.2 )        SDP-0980
 806  FORMAT (1H0, 28X, 13H INMAN VALUES / 31X, 56H MEDIAN     MEAN      DSDP-0981
     1EV.       SKEW.      2ND SKEW.      KURT.// 32X, F5.2, 3F9.2, 2F11.2)  SDP-0982
 8061 FORMAT (1H0, 28X, 64H INMAN VALUES    (COULD NOT CALCULATE 2ND SKEWSDP-0983
     1NESS AND KURTOSIS) / 29X, 35H MEDIAN     MEAN       DEV.      SKEW.//SDP-0984
     2 30X, F5.2, 3F9.2)                                                       SDP-0985
 8062 FORMAT (1H0, 28X, 55H INMAN PLUS FOLK AND WARD VALUES NOT CALCULATSDP-0986
     1ED BECAUSE / 29X, 50H NEXT TO LAST ACCUMULATED PERCENT WAS LESS THSDP-0987
     2AN 84 )                                                                  SDP-0988
 8051 FORMAT (1H0, 28X, 55H NOT ABLE TO CALCULATE TRASK, INMAN, OR FOLK SDP-0989
     1AND WARD  / 29X,  56H VALUES BECAUSE NEXT TO LAST ACCUMULATED PERCSDP-0990
     2ENT DIN NOT / 29X,10H EXCEED 72)                                         SDP-0991
 807  FORMAT (1H0, 28X, 21H FOLK AND WARD VALUE  / 31X, 53H MEAN        DSDP-0992
     1EV.  TYPE     SKEW.  TYPE    KURT.  TYPE //31X, F5.2, F11.2, 3X, ISDP-0993
     21, F11.2, 4X, I1, F10.2, 4X,I1)                                          SDP-0994
 8071 FORMAT (1H0, 28X, 55H COULD NOT CALCULATE FOLK AND WARD VALUES BECSDP-0995
     1AUSE NEXT / 29X,  47H TO LAST ACCUMULATED PERCENT DID NOT EXCEED  SDP-0996
     292 )                                                                     SDP-0997
 809  FORMAT (1H0, 28X, 42H DID NOT INTERPOLATE ANY PHI SIZES BECAUSE  /SDP-0998
     1  28X, 23H ACCUMULATED PERCENT AT , F5.2, 15H DID NOT EXCEED  /   SDP-0999
     2  28X, 11H 72PERCENT. )                                                  SDP-1000
 815  FORMAT(1H ,28X, 6H ONLY ,I3, 26H DETAIL CARDS SO ONLY SAND,    /   SDP-1001
     1 29X,37H SILT, CLAY RELATIONSHIPS CALCULATED.  )                         SDP-1002
 830  FORMAT (1H0, 28X, 64H   SUM OF FRACTION WEIGHTS DID NOT EQUAL POSTSDP-1003
     1 ANALYTICAL WEIGHT  / 31X, 11H WHICH WAS , F8.3, 39H . CHECK THE VSDP-1004
     2ALUES BELOW FOR ERRORS.    )                                             SDP-1005
C                                                                              SDP-1006
 831  FORMAT (1H0, 40X, 37H PHI  FRACTION  FRACTION  ACCUM.  T-      /   SDP-1007
     1              41X,38H SIZE  WEIGHT    PERCENT   PRCT  VALUE   / ) SDP-1008
```

```
C      DECIMAL PLACEMENT     XX.XX  XXX.XXX     XX.XX   XX.XX XX.XXX          SDP-1009
C                                                                             SDP-1010
  833  FORMAT (1H0, 40X, F5.2, F9.3, F9.2, F8.2, F7.3)                        SDP-1011
C                                                                             SDP-1012
  850  FORMAT (A5, A3, 5A2, I2, I2, I1, I2, I2, I1, 2I1, F5.0, A5, F5.2,     SDP-1013
     1 2F5.3, F2.0,1X, F2.0, F5.0, 9X, F5.0)                                  SDP-1014
C                                                                             SDP-1015
  860  FORMAT (1H1, 29X, 42H THIS BATCH OF CARDS CONTAINED DATA FROM  ,       SDP-1016
     2 I4,  9H SAMPLES  / 30X, 17H FOR A TOTAL OF  ,I4,  7H CARDS. )         SDP-1017
C                                                                             SDP-1018
  861  FORMAT (1H0, 29X  64H CONGRATULATIONS    NO ERRORS WERE FOUND IN TSDP-1019
     2HIS BATCH OF CARDS.  )                                                  SDP-1020
C                                                                             SDP-1021
C                                                                             SDP-1022
  863  FORMAT (1H0, 28X, 44H CARDS OUT OF ORDER ON THE FOLLOWING SAMPLES/SDP-1023
     2 30X,30H CRUISE     STATION     EXID   // 33X, A5, A3, A2    )         SDP-1024
C                                                                             SDP-1025
  864  FORMAT (1H0, 28X, 50H NO ZERO PERCENT CARDS ON THE FOLLOWING STATI SDP-1026
     1ONS  /  30X, 30H CRUISE     STATION     EXID // 33X, A5, A3, A2)       SDP-1027
C                                                                             SDP-1028
  865  FORMAT(1H0, 28X, 30H SORRY OLD CHAP, BUT YOU MADE , I3,                SDP-1029
     1 20H ERRORS ON THE DATA / 29X, 41H FOR THIS RUN. NEXT TIME BE MORESDP-1030
     2 CAREFUL )                                                              SDP-1031
       END                                                                    SDP-1032
```

APPENDIX 5 Listing of the Moment Measure Program

```
C      MOMENTS PROGRAM FOR GEOLOGY SECTION                                    MOM-0001
C       PROGRAM NUMBER 0214                                                   MOM-0002
C      PREPARED BY MONIQUE R. RONA                                            MOM-0003
C                                                                             MOM-0004
C                                                                             MOM-0005
       DIMENSION PHI(100), FRWT(100), PRCT(100), ACPC(100),                   MOM-0006
      1          X(100), F(100), U(100), UF(100), U2(100), U2F(100),         MOM-0007
      2U3(100), U3F(100), U4(100), U4F(100), V(10), FM(10), FMR(10),          MOM-0008
      3FMC(10), CMR(10)                                                       MOM-0009
C                                                                             MOM-0010
       ITR = 5                                                                MOM-0011
       ITW = 6                                                                MOM-0012
       TO = TIMEF(Y)                                                          MOM-0013
C                                                                             MOM-0014
 700   KK = 1                                                                 MOM-0015
       ASSIGN 103 TO N2                                                       MOM-0016
       ASSIGN 35 TO NC                                                        MOM-0017
       FRWTR = 0.0                                                            MOM-0018
       PAWTR = 0.0                                                            MOM-0019
C                                                                             MOM-0020
   1   READ INPUT TAPE ITR, 850, CRUZR, STATR, SMPLR, EXID, MO, DA, YR,       MOM-0021
      1LATA, LATB, LATC, LNGA, LNGB, LNGC, IQUD, ITYP, DEPTHR, PHIR,          MOM-0022
      2PRCTR, FRWTR, PAWTR, FRTH, PATH, CRLN, END                             MOM-0023
C                                                                             MOM-0024
 850   FORMAT (A5, A3, 5A2, I2, I2, I1, I2, I2, I1, 2I1, F5.0, A5, F5.2,      MOM-0025
      1 2F5.3, F2.0,1X, F2.0, F5.0, 9X, F5.0)                                 MOM-0026
C                                                                             MOM-0027
       FRWTR = FRWTR + (FRTH * 100.)                                          MOM-0028
       PAWTR = PAWTR + (PATH * 100.)                                          MOM-0029
       PHIR = (BTSNUF (PHIR)) * .001                                          MOM-0030
       IF (KK - 1) 30, 7, 30                                                  MOM-0031
C                                                                             MOM-0032
C      HEADER PREPARATION                                                     MOM-0033
C                                                                             MOM-0034
   7   IF (IQUD -2) 8, 9, 11                                                  MOM-0035
   8   IDH = LNGA + 100                                                       MOM-0036
       GO TO 10                                                               MOM-0037
   9   IDH = LNGA                                                             MOM-0038
  10   CONTINUE                                                               MOM-0039
B      DG = 450000000000                                                      MOM-0040
B      DK = 660000000000                                                      MOM-0041
       GO TO 23                                                               MOM-0042
  11   IF (IQUD - 4) 12,13, 15                                                MOM-0043
  12   IDH = LNGA + 100                                                       MOM-0044
       GO TO 14                                                               MOM-0045
  13   IDH = LNGA                                                             MOM-0046
  14   CONTINUE                                                               MOM-0047
B      DG = 620000000000                                                      MOM-0048
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B       DK = 660000000000                                                    MOM-0049
        GO TO 23                                                             MOM-0050
 15     IF (IQUD - 6) 16, 17, 19                                             MOM-0051
 16     IDH = LNGA                                                           MOM-0052
        GO TO 18                                                             MOM-0053
 17     IDH = LNGA + 100                                                     MOM-0054
 18     CONTINUE                                                             MOM-0055
B       DG = 450000000000                                                    MOM-0056
B       DK = 250000000000                                                    MOM-0057
        GO TO 23                                                             MOM-0058
 19     IF (IQUD - 8) 20, 21, 21                                             MOM-0059
 20     IDH = LNGA                                                           MOM-0060
        GO TO 22                                                             MOM-0061
 21     IDH = LNGA + 100                                                     MOM-0062
 22     CONTINUE                                                             MOM-0063
B       DG = 620000000000                                                    MOM-0064
B       DK = 250000000000                                                    MOM-0065
C                                                                            MOM-0066
 23     CRUZ = CRUZR                                                         MOM-0067
        STAT = STATR                                                         MOM-0068
        EXC    = EX1D                                                        MOM-0069
        DPTH = DEPTHR                                                        MOM-0070
        PAWT = PAWTR                                                         MOM-0071
C                                                                            MOM-0072
 24     WRITE OUTPUT TAPE ITW, 801, CRUZ, STAT, EXC, SMPLR, MO, DA, YR,      MOM-0073
       1LATA, LATB, LATC,  DG, 1DH, LNGB, LNGC,  DK, DEPTHR, CRLN            MOM-0074
C                                                                            MOM-0075
 801    FORMAT (1H1, 37X, 8H CRUISE , A5, 3X, 9H STATION , A3,  9H    EX IDMOM-0076
      1 , A2 // 29X, 14H SAMPLER TYPE , A2,  7H  DATE , A2, 1H/, A2, 1H/,MOM-0077
      2 A2,           7H  LAT. , I2, 1H-, I2, 1H., I1, A1, 9H   LONG. ,I3,MOM-0078
      3     1H-, I2, 1H., I1, A1 /  29X, 24H DEPTH FROM TOP OF CORE ,F5.0MOM-0079
      4,5H MM. , 16H LENGTH OF CORE ,F5.0, 5H MM.  )                         MOM-0080
C                                                                            MOM-0081
        IF (KK - 1) 35, 30, 30                                               MOM-0082
C                                                                            MOM-0083
B 30    IF (EXORF(STATR,STAT)) 100,31,100                                    MOM-0084
 31     IF (DPTH - DEPTHR)100, 32, 100                                       MOM-0085
B 32    IF (EXORF(EXC,EXID)) 100,33,100                                      MOM-0086
B 33    IF (EXORF(CRUZR,CRUZ)) 100,34,100                                    MOM-0087
C                                                                            MOM-0088
 34     GO TO NC, (35 ,50)                                                   MOM-0089
C                                                                            MOM-0090
 35     KK = 1                                                               MOM-0091
        K  = 2                                                               MOM-0092
 36     IF (PRCTR) 38, 37, 38                                                MOM-0093
 37     IF (FRWTR) 38, 39, 38                                                MOM-0094
C                                                                            MOM-0095
  38    ASSIGN 1990 TO N2                                                    MOM-0096
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      PHI (K) = -12.00                                                  MOM-0097
      GO TO 40                                                          MOM-0098
C                                                                       MOM-0099
 39   PHI (K) = PHIR                                                    MOM-0100
 40   PHIA = PHIR                                                       MOM-0101
      PRCT (K) = PRCTR                                                  MOM-0102
      ACPC (K) = 0.0                                                    MOM-0103
      FRWT(K) = FRWTR                                                   MOM-0104
      SUMPC  = 0.0                                                      MOM-0105
      SUMWT  = 0.0                                                      MOM-0106
 41   ASSIGN 50 TO NC                                                   MOM-0107
 42   GO TO 1                                                           MOM-0108
C                                                                       MOM-0109
 50   KK = KK + 1                                                       MOM-0110
      K = K + 1                                                         MOM-0111
      PHI (K) = PHIR                                                    MOM-0112
      IF (FRWTR) 52, 53, 52                                             MOM-0113
C                                                                       MOM-0114
 52   PRCTR = (FRWTR / PAWT) * 100.0                                    MOM-0115
      SUMWT = SUMWT + FRWTR                                             MOM-0116
 53   PRCT (K) = PRCTR                                                  MOM-0117
      SUMPC = SUMPC + PRCTR                                             MOM-0118
      ACPC (K) = SUMPC                                                  MOM-0119
      FRWT(K) = FRWTR                                                   MOM-0120
C                                                                       MOM-0121
 75   IF (PHIA - PHIR) 77, 76, 76                                       MOM-0122
 76   ASSIGN 1666 TO N2                                                 MOM-0123
 77   PHIA = PHIR                                                       MOM-0124
      GO TO 1                                                           MOM-0125
C                                                                       MOM-0126
C     LAST DETAIL CARD READ SO BEGIN CALCULATIONS                       MOM-0127
C                                                                       MOM-0128
 100  IF(SUMPC-99.94)1500,101,101                                       MOM-0129
  101 IF(SUMPC-100.06)102,102,1500                                      MOM-0130
  102 GO TO N2,(103,1666,1990)                                          MOM-0131
C                                                                       MOM-0132
C     1500 MEANS ACCUMULATED PERCENT NOT WITHIN 0.06 OF 100 PERCENT     MOM-0133
C                                                                       MOM-0134
 103  WRITE OUTPUT TAPE ITW, 802                                        MOM-0135
 802  FORMAT (1H0, 48X, 28H PHI    FRACTION  ACCUMULATED  /             MOM-0136
     1               49X, 28H SIZE   PERCENT    PERCENT   // )         MOM-0137
      KJK = KK + 1                                                      MOM-0138
      WRITE OUTPUT TAPE ITW, 8022, ((PHI(J), PRCT(J), ACPC(J)), J=2,KJK)MOM-0139
 8022 FORMAT (      48X,    F6.2,    F8.2,     F12.2)                   MOM-0140
C                                                                       MOM-0141
      SUMNL = ACPC (KK)                                                 MOM-0142
 110  WRITE OUTPUT TAPE 6, 111                                          MOM-0143
 111  FORMAT(1H0)                                                       MOM-0144
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```
      GO TO 200                                                                 MOM-0145
C                                                                               MOM-0146
 1666 WRITE OUTPUT TAPE ITW, 8666                                               MOM-0147
 8666 FORMAT (1H0 28X, 40H CARDS OUT OF ORDER. CHECK VALUES BELOW.     )        MOM-0148
      GO TO 700                                                                 MOM-0149
 1500 WRITE OUTPUT TAPE ITW, 830, PAWT                                          MOM-0150
 830  FORMAT (1H0, 28X, 64H   SUM OF FRACTION WEIGHTS DID NOT EQUAL POSTMOM-0151
     1 ANALYTICAL WEIGHT  / 31X, 11H WHICH WAS , F8.3, 39H . CHECK THE VMOM-0152
     2ALUES BELOW FOR ERRORS.    )                                              MOM-0153
      GO TO 700                                                                 MOM-0154
 1990 WRITE OUTPUT TAPE ITW, 8990                                               MOM-0155
 8990 FORMAT (1H0 28X, 36HNO ZERO PERCENT CARD. WHERE IS IT.         /         MOM-0156
     1   9X, 30H CHECK VALUES BELOW.              )                            MOM-0157
      GO TO 700                                                                 MOM-0158
C                                                                               MOM-0159
C     MOMENTS CALCULATIONS                                                      MOM-0160
C                                                                               MOM-0161
 200  N = KK                                                                    MOM-0162
      NMAX = 20                                                                 MOM-0163
      DO 113 I = 1,N                                                            MOM-0164
 113  F(I) = PRCT(I)                                                            MOM-0165
      NNN = N                                                                   MOM-0166
      U(1) = -(N/2)                                                             MOM-0167
      M = N/2                                                                   MOM-0168
      NN = (N/2) * 2                                                            MOM-0169
      IF (NN - N) 114, 115, 114                                                 MOM-0170
C                                                                               MOM-0171
 114  NNN = NNN + 1                                                             MOM-0172
 115  DO   116 I = 2,NNN                                                       MOM-0173
 116  U(I) = U(I-1) + 1.0                                                       MOM-0174
      N = N - 1                                                                 MOM-0175
      DO 117  I = 1,N                                                           MOM-0176
      X(I) = 0.5 * (PHI(I) + PHI(I+1))                                          MOM-0177
 117  F(I) = F(I+1)                                                             MOM-0178
C                                                                               MOM-0179
      SUM = 0.0                                                                 MOM-0180
      DO 118  I = 1,N                                                           MOM-0181
 118  SUM = SUM + F(I)                                                          MOM-0182
C                                                                               MOM-0183
      DO 119  I = 1,N                                                           MOM-0184
      UF(I) = U(I) * F(I)                                                       MOM-0185
      U2(I) = U(I) ** 2                                                         MOM-0186
      U2F(I) = U2(I) * F(I)                                                     MOM-0187
      U3(I) = U2(I) * U(I)                                                      MOM-0188
      U3F(I) = U3(I) * F(I)                                                     MOM-0189
      U4(I) = U2(I) ** 2                                                        MOM-0190
 119  U4F(I) = U4(I) * F(I)                                                     MOM-0191
C                                                                               MOM-0192
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```
C       CALCULATE V(I)                                                          MOM-0193
C                                                                               MOM-0194
        V(1) = 0.0                                                              MOM-0195
        V(2) = 0.0                                                              MOM-0196
        V(3) = 0.0                                                              MOM-0197
        V(4) = 0.0                                                              MOM-0198
        DO 120 I = 1,N                                                          MOM-0199
        V(1) = V(1) + UF(I)                                                     MOM-0200
        V(2) = V(2) + U2F(I)                                                    MOM-0201
        V(3) = V(3) + U3F(I)                                                    MOM-0202
 120    V(4) = V(4) + U4F(I)                                                    MOM-0203
        V(1) = V(1)/SUM                                                         MOM-0204
        V(2) = V(2) /SUM                                                        MOM-0205
        V(3) = V(3)/SUM                                                         MOM-0206
        V(4) = V(4)/SUM                                                         MOM-0207
C                                                                               MOM-0208
C       COMPUTE FIRST DATA MOMENT                                               MOM-0209
C       NOTE THAT IN USUAL CASES XNOT TO BE TAKEN AS MID-VALUE OF X.S           MOM-0210
C                                                                               MOM-0211
        M = NNN/2                                                               MOM-0212
        XNOT = X(M)                                                             MOM-0213
        FM(1) = V(1) + XNOT                                                     MOM-0214
C                                                                               MOM-0215
C       COMPUTE SECOND DATA MOMENT                                              MOM-0216
C                                                                               MOM-0217
        FM(2)= V(2) - V(1)**2                                                   MOM-0218
C                                                                               MOM-0219
C       COMPUTE THIRD DATA MOMENT                                               MOM-0220
C                                                                               MOM-0221
        FM(3)= V(3) - 3.*V(1)*V(2) + 2.*(V(1)**3)                               MOM-0222
C                                                                               MOM-0223
C       COMPUTE FOURTH DATA MOMENT                                              MOM-0224
C                                                                               MOM-0225
        FM(4)= V(4) - 4.*V(1)*V(3) + 6.*(V(1)**2)*V(2) - 3.*V(1)**4             MOM-0226
C                                                                               MOM-0227
C       CONVERSION OF DATA MOMENTS TO PHI MOMENTS                               MOM-0228
C                                                                               MOM-0229
        WR = 1.0                                                                MOM-0230
        FMR(1) = WR * FM(1)                                                     MOM-0231
        FMR(2) = WR**2  * FM(2)                                                 MOM-0232
        FMR(3) = WR**3  *FM(3)                                                  MOM-0233
        FMR(4) = WR**4  * FM(4)                                                 MOM-0234
C                                                                               MOM-0235
C       COMPUTE PHI MEAN                                                        MOM-0236
C                                                                               MOM-0237
        XBAR =FMR(1)                                                            MOM-0238
C                                                                               MOM-0239
C       COMPUTE PHI STANDARD DEVIATION                                          MOM-0240
```

```
C
      ST = SQRTF(FMR(2))
C
C     COMPUTE SKEWNESS (THIRD ALPHA MOMENT)
C
      SKEW =FM(3) /(FM(2)**1.5)
C
C     COMPUTE KURTOSIS (FOURTH ALPHA MOMENT)
C
      FKURT=  FM(4)/ FM(2)**2
C
C     SHEPPARD CORRECTION FOR SECOND DATA MOMENT
C
      FMC(2) = FM(2) - (WR**2 / 12.)
C
C     SHEPPARD CORRECTION FOR FOURTH MOMENT DATA
C
      FMC(4) = FM(4) - (WR**2*FM(2))/2. + (WR**4 * 7./240.)
C
C     CONVERSION OF CORRECTED DATA MOMENTS TO CORRECTED PHI MOMENTS
C
      CMR(2) = WR * FMC(2)
      CMR(4) = WR**2 * FMC(4)
C
C     CORRECTED PHI STANDARD DEVIATION
      STC = SQRTF(FMC(2))
C
C     CORRECTED SKEWNESS
C
      SKEWC =FM(3) /FMC(2)**1.5
C
C     CORRECTED  KURTOSIS
C
      CKURT =FMC(4) /FMC(2)**2
C
C     READY TO PRINT OUTPUT
C
C     WRITE OUTPUT TAPE 6, 29,CRUS,ISTA,ID
C
 29   FORMAT(25X,17H MOMENTS CRUISE  A5,6H STA   I3, A6//)
C
      WRITE OUTPUT TAPE 6,121, FM(1)
 121  FORMAT(15X,20H FIRST DATA MOMENT =  F11.3//)
C
      WRITE OUTPUT TAPE 6,122, FM(2)
 122  FORMAT(15X,21H SECOND DATA MOMENT =  F10.3//)
C
      WRITE OUTPUT TAPE 6,123, FM(3)
```

MOM-0241
MOM-0242
MOM-0243
MOM-0244
MOM-0245
MOM-0246
MOM-0247
MOM-0248
MOM-0249
MOM-0250
MOM-0251
MOM-0252
MOM-0253
MOM-0254
MOM-0255
MOM-0256
MOM-0257
MOM-0258
MOM-0259
MOM-0260
MOM-0261
MOM-0262
MOM-0263
MOM-0264
MOM-0265
MOM-0266
MOM-0267
MOM-0268
MOM-0269
MOM-0270
MOM-0271
MOM-0272
MOM-0273
MOM-0274
MOM-0275
MOM-0276
MOM-0277
MOM-0278
MOM-0279
MOM-0280
MOM-0281
MOM-0282
MOM-0283
MOM-0284
MOM-0285
MOM-0286
MOM-0287
MOM-0288

```
  123  FORMAT(15X,20H THIRD DATA MOMENT =  F11.3//)                      MOM-0289
C                                                                       MOM-0290
      WRITE OUTPUT TAPE 6,124, FM(4)                                    MOM-0291
  124  FORMAT(15X,21H FOURTH DATA MOMENT =  F10.3///)                    MOM-0292
C                                                                       MOM-0293
      WRITE OUTPUT TAPE 6, 125                                          MOM-0294
  125  FORMAT(15X,44H CONVERSION OF DATA MOMENTS TO PHI MOMENTS , //)    MOM-0295
C                                                                       MOM-0296
      WRITE OUTPUT TAPE 6,126, (FMR(I), I = 1,4)                        MOM-0297
  126  FORMAT (18X, 4F12.3 ///)                                          MOM-0298
C                                                                       MOM-0299
      WRITE OUTPUT TAPE 6,127, XBAR                                     MOM-0300
  127  FORMAT(15X,11H PHI MEAN =  F7.3//)                                MOM-0301
C                                                                       MOM-0302
      WRITE OUTPUT TAPE 6,128, ST                                       MOM-0303
  128  FORMAT(15X,27H PHI STANDARD DEVIATION =  F13.3//)                 MOM-0304
C                                                                       MOM-0305
      WRITE OUTPUT TAPE 6,129, SKEW                                     MOM-0306
  129  FORMAT(15X,32H SKEWNESS (THIRD ALPHA MOMENT) =  F8.3//)           MOM-0307
      WRITE OUTPUT TAPE 6,130, FKURT                                    MOM-0308
  130  FORMAT(15X,33H KURTOSIS (FOURTH ALPHA MOMENT) =  F7.3//)          MOM-0309
C                                                                       MOM-0310
      WRITE OUTPUT TAPE 6,131, FMC(2)                                   MOM-0311
  131  FORMAT(15X,45H SHEPPARD CORRECTION FOR SECOND DATA MOMENT = F12.3MOM-0312
     1/)                                                                MOM-0313
C                                                                       MOM-0314
      WRITE OUTPUT TAPE 6,132, FMC(4)                                   MOM-0315
  132  FORMAT(15X,45H SHEPPARD CORRECTION FOR FOURTH DATA MOMENT = F12.3MOM-0316
     1/)                                                                MOM-0317
C                                                                       MOM-0318
      WRITE OUTPUT TAPE 6, 133                                          MOM-0319
  133  FORMAT (1H 65H CONVERSION OF CORRECTED DATA MOMENTS TO CORRECTED  MOM-0320
     1PHI MOMENTS , ///)                                                MOM-0321
C                                                                       MOM-0322
      WRITE OUTPUT TAPE 6, 43, CMR(2), CMR(4)                           MOM-0323
   43  FORMAT (18X, 2F12.3//)                                           MOM-0324
C                                                                       MOM-0325
      WRITE OUTPUT TAPE 6, 44, STC                                      MOM-0326
   44  FORMAT(15X,35H CORRECTED PHI STANDARD DEVIATION =  F7.3//)        MOM-0327
C                                                                       MOM-0328
      WRITE OUTPUT TAPE 6, 45,SKEWC                                     MOM-0329
   45  FORMAT(15X,21H CORRECTED SKEWNESS = F10.3//)                      MOM-0330
C                                                                       MOM-0331
      WRITE OUTPUT TAPE 6, 46, CKURT                                    MOM-0332
   46  FORMAT(15X,21H CORRECTED KURTOSIS = F10.3//)                      MOM-0333
C                                                                       MOM-0334
      WRITE OUTPUT TAPE 6, 47, XNOT                                     MOM-0335
   47  FORMAT (1H  F10.2 //)                                            MOM-0336
```

```
C       TIMY = TIMEF(Y) - TO                                              MOM-0337
C       WRITE OUTPUT TAPE 6, 566, TIMY                                    MOM-0338
  566   FORMAT(1H1, F10.3)                                                MOM-0339
        GO TO 700                                                         MOM-0340
        END                                                               MOM-0341
                                                                          MOM-0342
                                                                          MOM-0343
```

APPENDIX 6 Listing of Subroutine BTSNU

```
*     FAP                                                                    BTSN-001
*BTSNU AND XBTSNU ENABLE FORTRAN TO READ SIGN-OVER-UNITS                      BTSN-002
       COUNT   200                                                           BTSN-003
       ENTRY   BTSNU                                                         BTSN-004
       ENTRY   XBTSNU                                                        BTSN-005
       ENTRY   BTCBZ1                                                        BTSN-006
       TITLE                                                                 BTSN-007
*THIS SUBROUTINE IS A JACKET AROUND BTCBZ1 WHICH ALLOWS                       BTSN-008
* FORTRAN PROGRAMS TO READ NUMBERS PUNCHED WITH                               BTSN-009
* SIGN-OVER-UNITS.                                                           BTSN-010
*IT IS A LIBRARY FUNCTION-TYPE SUBROUTINE                                    BTSN-011
BTSNU  STL     FLAG    NONZERO FOR FLOATING                                  BTSN-012
       TRA     *+2                                                           BTSN-013
XBTSNU STZ     FLAG     ZERO FOR FIXED                                       BTSN-014
       SXA     IR2,2                                                         BTSN-015
       SXA     IR4,4                                                         BTSN-016
       STO     SAVE      LEFT-ADJUSTED BCD NUMBER IN AC. 1 TO 6 CHARACTRS    BTSN-017
       STO     ACSAVE                                                        BTSN-018
       AXT     36,2       6*I    (INITIAL I=6)                              BTSN-019
       AXT     6,4        INITIAL J=6                                        BTSN-020
       ANA     MASK       SAVE RIGHTMOST CHARACTER                           BTSN-021
       SUB     BLANK      IS IT A BLANK.                                     BTSN-022
       TNZ     FOUND      NO. THEN ITS A NUMBER. GO.                         BTSN-023
       CAL     SAVE       YES, IT WAS A BLANK.                               BTSN-024
       LGR     6          THEN TRY THE NEXT CHARACTER.                       BTSN-025
       SLW     SAVE                                                          BTSN-026
       TNX     ALLBLK,4,1    J=J-1                                           BTSN-027
       TXI     *-7,2,-6    6*I=6*(I-1)                                       BTSN-028
FOUND  SXA     *+4,2      SUPPLY CURRENT 6*I, AND                            BTSN-029
       SXA     *+4,4       SUPPLY CURRENT J                                  BTSN-030
       TSX     BTCBZ1,4    TO CALLING SEQUENCE                               BTSN-031
       AXC     SAVE,1                                                        BTSN-032
       LGR     **         6*I                                                BTSN-033
       AXT     **,2       J                                                  BTSN-034
       TRA     ERROR      ERROR RETURN                                       BTSN-035
       NZT     FLAG       SUCCESSRETURN. BINARY RESULT IN AC                 BTSN-036
       TRA     SHIFT      USER WANTS FIXED POINT                             BTSN-037
       ORA     FLOAT     USER WANTS FLOATING POINT                           BTSN-038
       FAD     FLOAT      ZERO+UNNORMALIZED (B35) FLOATING INTEGER           BTSN-039
IR2    AXT     **,2       LEAVE RESULT IN AC FOR CALLING PROGRAM             BTSN-040
IR4    AXT     **,4                                                          BTSN-041
       TRA     1,4       RETURN                                              BTSN-042
SHIFT  TOV     *+1                                                           BTSN-043
       ALS     18         NUMBER TO DECREMENT                                BTSN-044
       TNO     IR2        OK. NUMBER IS NOT TOO LARGE FOR FORTRAN            BTSN-045
       WTDA    3          ERROR. NUMBER IS TOO LARGE, SO LET USER KNOW       BTSN-046
       RCHA    COM1                                                          BTSN-047
       TRA     WRITE                                                         BTSN-048
```

```
 ERROR WTDA     3           ITTEGITIMATE CHARACTER                          BTSN-049
       RCHA     COM2                                                        BTSN-050
       TRA      WRITE                                                       BTSN-051
ALLBLK WTDA     3                                                           BTSN-052
       RCHA     COM3                                                        BTSN-053
       TRA      IR2                                                         BTSN-054
 WRITE WTDA     3           PRINT WHATEVER WAS FED.                         BTSN-055
       RCHA     COM4                                                        BTSN-056
       TRA      IR2                                                         BTSN-057
 COM1  IOCD     MES1,,12                                                    BTSN-058
 COM2  IOCD     MES2,,12                                                    BTSN-059
 COM3  IOCD     MES3,,8                                                     BTSN-060
 COM4  IOCP     MES4,,8                                                     BTSN-061
       IOCD     ACSAVE,,1                                                   BTSN-062
MES1   BCI      7,1THE NUMBER CONVERTED BY XBTSNU IS TOO LAR                BTSN-063
       BCI      5,GE FOR A FORTRAN-TYPE INTEGER                             BTSN-064
MES2   BCI      7, BTSNU OR XBTSNU WAS FED SOME DATA WHICH                  BTSN-065
       BCI      5,WAS NOT STRICTLY NUMERIC BCD                              BTSN-066
MES3   BCI      8, BTSNU OR XBTSNU WAS FED 6 SUCCESSIVE BLANKS              BTSN-067
MES4   BCI      8,  THE (HOPEFULLY) BCD DATA WORD ENCOUNTERED WAS           BTSN-068
ACSAVE PZE                                                                 BTSN-069
 FLAG  PZE                                                                 BTSN-070
SAVE   PZE                                                                 BTSN-071
MASK   OCT      77                                                         BTSN-072
 BLANK OCT      60                                                         BTSN-073
 FLOAT OCT      233000000000                                               BTSN-074
*         BTCBZ1 - CONVERSION OF PACKED ZONED BCD TO BINARY.               BTSN-075
*BTCBZ1 IS A MODIFICATION OF -                                             BTSN-076
*    CBZ  CONVERSION OF PACKED ZONED BCD TO BINARY                         BTSN-077
*STANDARD SHARE BEGIN MACRO                                                BTSN-078
       TITLE                                                               BTSN-079
BTCBZ1 TXL      *+4,,                                                      BTSN-080
       AXT ,2                                                              BTSN-081
       AXT ,1                                                              BTSN-082
       TRA 5,4                                                             BTSN-083
       SXA *-2,1                                                           BTSN-084
       SXA *-4,2                                                           BTSN-085
*INITIALIZATION                                                            BTSN-086
       TOV *+1                  TURN OFF AC OVERFLOW INDICATOR             BTSN-087
 CBZ71 TRA      CBZ69    (XEC 1,4 LATER)                                   BTSN-088
       CAL 0,1                                                             BTSN-089
       LDQ 1,1                                                             BTSN-090
       XEC 2,4                  LEFT-JUSTIFY SOURCE WORD IN MQ             BTSN-091
       XEC 3,4                  J TO IR2                                   BTSN-092
       TIX CBZ5,2,6             IF J IS GREATER THAN SIX                   BTSN-093
*IF J IS NOT GREATER THAN SIX                                              BTSN-094
       PXA                      CLEAR AC                                   BTSN-095
       XEC CBZ7T,2              CONVERT THE FIRST J-1 DIGITS TO BINARY     BTSN-096
```

```
        TXH  CBZ6,1,CBZ12T+50   IF ILLEGITIMATE CHARACTER WAS MET          BTSN-097
        SUB  CBZ8T,2            REMOVE ACCUMULATED ADDRESS PARTS          BTSN-098
        ARS  15                 RIGHT-JUSTIFY BINARY RESULT IN AC         BTSN-099
*DEAL WITH ZONED UNITS DIGIT                                              BTSN-100
CBZ1    STO  CBZ15E             PRESERVE RESULT                           BTSN-101
        PXA                     CLEAR AC                                  BTSN-102
        LGL  6                  ZONED DIGIT TO AC                         BTSN-103
        PAC  ,1                 TO IR1, COMPLEMENTED                      BTSN-104
        XEC  CBZ13T,1           EXAMINE FINAL CHARACTER                   BTSN-105
*IF PLUS ZONING FOUND                                                     BTSN-106
        ADD  CBZ15E             FORM FINAL BINARY RESULT IN AC            BTSN-107
        TNO  CBZ+1              GO TO NORMAL RETURN IF NO OVERFLOW OCCURREDBTSN-108
*ERROR RETURN CAUSED BY OVERFLOW                                          BTSN-109
CBZ2    AXT  1,1                ERROR CODE IS 1                           BTSN-110
CBZ3    SXD  CBZ,1                                                        BTSN-111
        TXI  CBZ+1,4,1                                                    BTSN-112
*IF MINUS ZONING FOUND                                                    BTSN-113
CBZ4    PXA  ,1                 NUMERICAL VALUE OF UNITS POSITION TO AC   BTSN-114
        SSM                     MAKE AC NEGATIVE                          BTSN-115
        SUB  CBZ15E             FORM FINAL BINARY RESULT IN AC            BTSN-116
        TNO  CBZ+1              GO TO NORMAL RETURN IF NO OVERFLOW OCCURREDBTSN-117
        TRA  CBZ2               OTHERWISE GO TO APPROPRIATE ERROR RETURN  BTSN-118
*IF J IS GREATER THAN SIX                                                 BTSN-119
CBZ5    STQ  CBZ15E             PRESERVE FIRST SIX DIGITS                 BTSN-120
        CAL  1,1                                                          BTSN-121
        LDQ  2,1                                                          BTSN-122
        XEC  2,4                LEFT-JUSTIFY SECOND SOURCE WORD IN MQ     BTSN-123
        CAL  CBZ15E                                                       BTSN-124
        STQ  CBZ15E             PRESERVE LAST J-6 CHARACTERS              BTSN-125
        LGR  36                 FIRST SIX DIGITS TO MQ, AC CLEARED        BTSN-126
        CAQ  CBZ12T,1,6         CONVERT FIRST SIX DIGITS                  BTSN-127
        TXH  CBZ6,1,CBZ12T+60   IF ILLEGITIMATE CHARACTER WAS MET         BTSN-128
        SUB  CBZ10T-6           REMOVE ACCUMULATED ADDRESS PARTS          BTSN-129
        ARS  15                 RIGHT-JUSTIFY BINARY RESULT IN AC         BTSN-130
        STO  CBZ16E             PRESERVE IT                               BTSN-131
        LDQ  CBZ11T,2                                                     BTSN-132
        MPY  CBZ16E             MULTIPLY BY 10**(J-6)                     BTSN-133
        LLS  35                 FORCE DETECTION OF OVERFLOW               BTSN-134
        LDQ  CBZ15E             LOAD LAST J-6 CHARACTERS                  BTSN-135
        STO  CBZ15E             PRESERVE PRODUCT                          BTSN-136
        PXA                     CLEAR AC                                  BTSN-137
        XEC  CBZ7T,2            CONVERT LAST J-7 DIGITS                   BTSN-138
        TXH  CBZ6,1,CBZ12T+50   IF ILLEGITIMATE CHARACTER WAS MET         BTSN-139
        SUB  CBZ8T,2            REMOVE ACCUMULATED ADDRESS PARTS          BTSN-140
        ARS  15                 RIGHT-JUSTIFY BINARY RESULT IN AC         BTSN-141
        ADD  CBZ15E             RESULT OF FIRST CONVERSION                BTSN-142
        TRA  CBZ1               GO TO DEAL WITH ZONED UNITS DIGIT         BTSN-143
*ERROR RETURN CAUSED BY ILLEGITIMATE CHARACTER                            BTSN-144
```

```
CBZ6    AXT 2,1                    ERROR CODE IS 2                          BTSN-145
        TRA CBZ3                                                            BTSN-146
*TABLE OF CONVERT INSTRUCTIONS FOR LAST CONVERSION                          BTSN-147
        CAQ  CBZ12T,1,5                                                     BTSN-148
        CAQ  CBZ12T+10,1,4                                                  BTSN-149
        CAQ  CBZ12T+20,1,3                                                  BTSN-150
        CAQ  CBZ12T+30,1,2                                                  BTSN-151
        CAQ  CBZ12T+40,1,1                                                  BTSN-152
        CAQ  CBZ12T+50,1,0                                                  BTSN-153
CBZ7T   BSS 0                                                               BTSN-154
*TABLE OF ACCUMULATED ADDRESS PARTS IN LAST CONVERT INSTRUCTION              BTSN-155
        DEC      5          FAP FLAGGED A RELOCATION ERROR WHEN             BTSN-156
        DEC      4          TRYING TO ASSEMBLE THE VFD                      BTSN-157
        DEC      3          INSTRUCTIONS HERE.  SO THIS                     BTSN-158
        DEC      2          TABLE IS GENERATED ONCE AT                      BTSN-159
        DEC      1          CBZ69                                           BTSN-160
        DEC      0                                                          BTSN-161
CBZ8T   BSS 0                                                               BTSN-162
*TABLE OF CONVERT INSTRUCTIONS                                              BTSN-163
        CAQ  CBB7T,1,6                                                      BTSN-164
        CAQ  CBB7T+10,1,5                                                   BTSN-165
        CAQ  CBB7T+20,1,4                                                   BTSN-166
        CAQ  CBB7T+30,1,3                                                   BTSN-167
        CAQ  CBB7T+40,1,2                                                   BTSN-168
        CAQ  CBB7T+50,1,1                                                   BTSN-169
CBB4T   CAQ CBB7T+60,1,0                                                    BTSN-170
*TABLE OF ACCUMULATED ADDRESS PARTS                                         BTSN-171
        DEC      6          FAP FLAGGED A RELOCATION ERROR WHEN             BTSN-172
        DEC      5          TRYING TO ASSEMBLE THE VFD                      BTSN-173
        DEC      4          INSTRUCTIONS HERE.  SO THIS                     BTSN-174
        DEC      3          TABLE IS GENERATED ONCE AT                      BTSN-175
        DEC      2          CBB69                                           BTSN-176
        DEC      1                                                          BTSN-177
CBB5T   PZE                                                                 BTSN-178
*TABLE OF POWERS OF TEN                                                     BTSN-179
        DEC  1000000                                                        BTSN-180
        DEC  100000                                                         BTSN-181
        DEC  10000                                                          BTSN-182
        DEC  1000                                                           BTSN-183
        DEC  100                                                            BTSN-184
        DEC  10                                                             BTSN-185
CBB6T   BSS 0                                                               BTSN-186
*CONVERSION TABLE                                                           BTSN-187
CBB7T   PZE CBB7T+10,,          000000                                      BTSN-188
        PZE CBB7T+10,,12500     100000                                      BTSN-189
        PZE CBB7T+10,,25000     200000                                      BTSN-190
        PON CBB7T+10,,4732      300000                                      BTSN-191
        PON CBB7T+10,,17232     400000                                      BTSN-192
```

```
PON  CBB7T+10,,29732    500000    BTSN-193
PTW  CBB7T+10,,9464     600000    BTSN-194
PTW  CBB7T+10,,21964    700000    BTSN-195
PTH  CBB7T+10,,1696     800000    BTSN-196
PTH  CBB7T+10,,14196    900000    BTSN-197
PZE  CBB7T+20,,         00000     BTSN-198
PZE  CBB7T+20,,1250     10000     BTSN-199
PZE  CBB7T+20,,2500     20000     BTSN-200
PZE  CBB7T+20,,3750     30000     BTSN-201
PZE  CBB7T+20,,5000     40000     BTSN-202
PZE  CBB7T+20,,6250     50000     BTSN-203
PZE  CBB7T+20,,7500     60000     BTSN-204
PZE  CBB7T+20,,8750     70000     BTSN-205
PZE  CBB7T+20,,10000    80000     BTSN-206
PZE  CBB7T+20,,11250    90000     BTSN-207
PZE  CBB7T+30,,         0000      BTSN-208
PZE  CBB7T+30,,125      1000      BTSN-209
PZE  CBB7T+30,,250      2000      BTSN-210
PZE  CBB7T+30,,375      3000      BTSN-211
PZE  CBB7T+30,,500      4000      BTSN-212
PZE  CBB7T+30,,625      5000      BTSN-213
PZE  CBB7T+30,,750      6000      BTSN-214
PZE  CBB7T+30,,875      7000      BTSN-215
PZE  CBB7T+30,,1000     8000      BTSN-216
PZE  CBB7T+30,,1125     9000      BTSN-217
PZE  CBB7T+40,,         000       BTSN-218
PZE  CBB7T+40,4,12      100       BTSN-219
PZE  CBB7T+40,,25       200       BTSN-220
PZE  CBB7T+40,4,37      300       BTSN-221
PZE  CBB7T+40,,50       400       BTSN-222
PZE  CBB7T+40,4,62      500       BTSN-223
PZE  CBB7T+40,,75       600       BTSN-224
PZE  CBB7T+40,4,87      700       BTSN-225
PZE  CBB7T+40,,100      800       BTSN-226
PZE  CBB7T+40,4,112     900       BTSN-227
PZE  CBB7T+50,,         00        BTSN-228
PZE  CBB7T+50,2,1       10        BTSN-229
PZE  CBB7T+50,4,2       20        BTSN-230
PZE  CBB7T+50,6,3       30        BTSN-231
PZE  CBB7T+50,,5        40        BTSN-232
PZE  CBB7T+50,2,6       50        BTSN-233
PZE  CBB7T+50,4,7       60        BTSN-234
PZE  CBB7T+50,6,8       70        BTSN-235
PZE  CBB7T+50,,10       80        BTSN-236
PZE  CBB7T+50,2,11      90        BTSN-237
PZE  CBB7T+60,,         0         BTSN-238
PZE  CBB7T+60,1         1         BTSN-239
PZE  CBB7T+60,2         2         BTSN-240
```

```
        PZE  CBB7T+60,3          3                                          BTSN-241
        PZE  CBB7T+60,4          4                                          BTSN-242
        PZE  CBB7T+60,5          5                                          BTSN-243
        PZE  CBB7T+60,6          6                                          BTSN-244
        PZE  CBB7T+60,7          7                                          BTSN-245
        PZE  CBB7T+60,,1         8                                          BTSN-246
        PZE  CBB7T+60,1,1        9                                          BTSN-247
*     THIS PART OF THE CONVERSION TABLE IS ONLY REACHED AFTER A WRONG ...BTSN-248
*     CHARACTER HAS BEEN ENCOUNTERED                                       BTSN-249
        DUP  1,61                                                          BTSN-250
        PZE  CBB7T+61                                                      BTSN-251
*ERASABLE STORAGE                                                         BTSN-252
CBB8E   BSS  1                   FOR INTERMEDIATE RESULT OF CONVERSION     BTSN-253
CBB9E   BSS  1                   FOR MULTIPLIER OF POWER OF TEN            BTSN-254
*TABLES SHARED WITH CBB                                                   BTSN-255
CBZ9T   EQU  CBB4T               TABLE OF CONVERT INSTRUCTIONS             BTSN-256
CBZ10T  EQU  CBB5T               TABLE OF ACCUMULATED ADDRESS PARTS        BTSN-257
CBZ11T  EQU  CBB6T               TABLE OF POWERS OF TEN                    BTSN-258
CBZ12T  EQU  CBB7T               CONVERSION TABLE                          BTSN-259
*TABLE FOR INTERPRETING ZONED UNITS POSITION                              BTSN-260
*     UNZONED DECIMAL DIGITS ARE LEFT UNCHANGED IN AC                      BTSN-261
        DUP  1,10                                                          BTSN-262
CBZ13T  NOP                                                              BTSN-263
*     ILLEGITIMATE CHARACTERS CAUSE TRANSFER OF CONTROL TO ERROR RETURN    BTSN-264
        DUP  1,7                                                           BTSN-265
        TRA  CBZ6                                                          BTSN-266
*     ZONING IS REMOVED IN AC FROM PLUS-ZONED DIGITS 1 - 9                 BTSN-267
        DUP  1,9                                                           BTSN-268
        SUB  CBZ14C                                                        BTSN-269
        PXA                      CLEAR AC IF +0 WAS READ                   BTSN-270
*     ILLEGITIMATE CHARACTERS CAUSE TRANSFER OF CONTROL TO ERROR RETURN    BTSN-271
        DUP  1,6                                                           BTSN-272
        TRA  CBZ6                                                          BTSN-273
*     FOR MINUS-ZONED DIGITS IR1 RECEIVES NUMERICAL VALUES 1 - 9, 0        BTSN-274
        TXI  CBZ4,1,34                                                     BTSN-275
        TXI  CBZ4,1,36                                                     BTSN-276
        TXI  CBZ4,1,38                                                     BTSN-277
        TXI  CBZ4,1,40                                                     BTSN-278
        TXI  CBZ4,1,42                                                     BTSN-279
        TXI  CBZ4,1,44                                                     BTSN-280
        TXI  CBZ4,1,46                                                     BTSN-281
        TXI  CBZ4,1,48                                                     BTSN-282
        TXI  CBZ4,1,50                                                     BTSN-283
        TXI  CBZ4,1,42                                                     BTSN-284
*     ILLEGITIMATE CHARACTERS CAUSE TRANSFER OF CONTROL TO ERROR RETURN    BTSN-285
        DUP  1,21                                                          BTSN-286
        TRA  CBZ6                                                          BTSN-287
*GENERATE TABLE OF ACCUMULATED ADDRESS PARTS                              BTSN-288
```

```
 CBZ69 AXT      5,2                                                    BTSN-289
       AXT      CBZ12T+25,1                                            BTSN-290
       TXI      *+1,1,5                                                BTSN-291
       PXA      ,1                                                     BTSN-292
       XCA                                                             BTSN-293
       MPY      CBZ8T-1,2                                              BTSN-294
       STQ      CBZ8T-1,2                                              BTSN-295
       TIX      *-5,2,1                                                BTSN-296
       CLA      CBXEC     REPLACE TSX WITH XEC 1,4                     BTSN-297
       STO      CBZ71                                                  BTSN-298
*GENERATE TABLE OF ACCUMULATED ADDRESS PARTS.                          BTSN-299
 CBB69 AXT      6,2                                                    BTSN-300
       AXT      CBB7T+30,1                                             BTSN-301
       TXI      *+1,1,5                                                BTSN-302
       PXA      ,1                                                     BTSN-303
       XCA                                                             BTSN-304
       MPY      CBB5T,2                                                BTSN-305
       STQ      CBB5T,2                                                BTSN-306
       TIX      *-5,2,1                                                BTSN-307
       TRA      CBZ71                                                  BTSN-308
 CBXEC XEC      1,4         S TO IR18 COMPLEMENTED.                    BTSN-309
*CONSTANT                                                              BTSN-310
CBZ14C OCT 20                    PLUS ZONING                           BTSN-311
*ERASABLE STORAGE                                                      BTSN-312
CBZ15E EQU CBB8E                 FOR INTERMEDIATE RESULT OF CONVERSION BTSN-313
CBZ16E EQU CBB9E                 FOR MULTIPLIER OF POWER OF TEN        BTSN-314
CBZMD1 EQU      BTCBZ1                                                 BTSN-315
 CBZ   EQU      CBZMD1                                                 BTSN-316
FCBZ   EQU      BTSNU                                                  BTSN-317
XFCBZ  EQU      XBTSNU                                                 BTSN-318
       DETAIL                                                          BTSN-319
       END                                                             BTSN-320
```

APPENDIX 7 Listing of Subroutine EXORF

```
*       FAP                                                                 EXOR-001
*   FORTRAN LIBRARY FUNCTION / EXOR                                         EXOR-002
          COUNT   8                                                         EXOR-003
          LBL     EXOR,X                                                    EXOR-004
          ENTRY   EXOR                                                      EXOR-005
          REM     RETURNS THE EXCLUSIVE OR OF TWO ARGUMENTS TO THE          EXOR-006
          REM     ACCUMULATOR.  IT MAY BE USED ONLY IN BOOLEAN STATEMENTS.  EXOR-007
 EXOR     STQ     A                                                         EXOR-008
          ERA     A                                                         EXOR-009
          TRA     1,4                                                       EXOR-010
 A        BSS     1                                                         EXOR-011
          END                                                               EXOR-012
```

APPENDIX 8 Listing of Subroutine XRND

```
*       FAP                                                                 XRND-001
C       SUBROUTINE XRND                                                     XRND-002
C       FAP SUBROUTINE TO PERFORM THE NEAREST ROUND-OFF.                    XRND-003
C                                                                           XRND-004
          COUNT   7                                                         XRND-005
          ENTRY   XRND                                                      XRND-006
  XRND    UFA     *+4                                                       XRND-007
          FRN                                                               XRND-008
          ALS     18                                                        XRND-009
          TRA     1,4                                                       XRND-010
          OCT     233000000000                                              XRND-011
          END                                                               XRND-012
```

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