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# Additional geologic applications of the computerized Stratigraphic Analysis Techniques System (STRATS)

by

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## Introduction

The Stratigraphic Analysis Techniques System (STRATS) software (Boger, 1986) is part of the National Coal Resources Data System (NCRDS) of the U.S. Geological Survey. STRATS, which runs on a Prime minicomputer, produces essentially camera-ready computer graphics in a correlation-diagram format. STRATS is used to graphically display stratigraphic data from measured sections and from drill holes. These data are stored in PACER, the database managing system for the NCRDS. It is assumed that the reader has a working knowledge of PACER, STRATTHK, LSTRATUS, STRATS, and STRATFE software; and ED, the line-oriented text editor on the Prime.

Three variations of STRATS usage and procedures are described in this report. These variations expand the versatility of the program, and add detail to the graphics generated. The procedures explained in this report apply to the versions of STRATFE and STRATS installed on the U. S. Geological Survey Prime 9650 minicomputer in Lakewood, Colorado, in April, 1987.

The first variation gives the capability to display formation names adjacent to the stratigraphic column. The second procedure allows for more variety in the lithologic symbols used in the stratigraphic column. The third variation allows partial drill holes or measured sections to be displayed. All of these capabilities are generated by using ED, the line-oriented Prime editor, to edit the input file to STRATS. The third variation also requires use of the update procedures within PACER.

The ability to display formation names and additional lithologic symbols may be formally incorporated into the STRATS software in the future, as the capabilities of STRATS are constantly being expanded. The ability to display partial stratigraphic sections using STRATS exclusively is presently in testing. Currently, a user can employ the three procedures detailed in this report to get the desired results.

Data from Mississippian-Pennsylvanian siliciclastic rocks of Oklahoma (Keighin and Flores, 1987) are used in this report to illustrate the display of formation names and additional lithologic symbols. Data from Roberts (1987), which represent Upper Cretaceous sedimentary rocks in New Mexico, are used to illustrate the display of partial stratigraphic sections from drill holes and outcrop.

## I. TO ADD FORMATION NAMES

The program STRATFE generates an input file to STRATS. We call this file the <u>ANYNAME</u> file; it is also known as the data set or database file (Boger, 1986, p. 2). An unedited <u>ANYNAME</u> file is shown in figure 1. This <u>ANYNAME</u> file contains the information for three drill holes: data points 1-16, 1-12, and 2-8. Note that there are presently no entries in the **BEDNAME** position (the NDENDE on each of the unit records). Because no bednames are included, we cannot use a datum other than elevation for the STRATS plot. Figures 2 and 3 show part of the STRATS plot

```
 1   1   0   9   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0
5.1-12             4N  6W 25 -6008.0      34.79      97.79
5.               USGD-FLORES NDE          PLEASANT VIE771002OKLAHOMA    GRADY
 5.                   0.00   78.00SLNDENDE                     SDY
10.                  78.00  149.00SLNDENDE
15.                 149.00  169.00SLNDENDE                     SDY
20.                 169.00  178.00SLNDENDE
25.                 178.00  248.00SLNDENDE                     SDY
30.                 248.00  295.00SLNDENDE
35.                 295.00  339.00SLNDENDE                     SDY
40.                 339.00  649.00SLNDENDE
45.                 649.00  660.00SLNDENDE                     SDY
 1   1   0   3   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0
5.1-16             5N  6W 23 -5705.0      34.98      97.70
5.               USGD-FLORES NDE          N. CHITWOOD 6401060KLAHOMA    GRADY
 5.                   0.00    9.00SLNDENDE                     SDY
10.                   9.00  315.00SLNDENDE
15.                 315.00  327.00SLNDENDE                     SDY
 1   1   0  23   0   0   0   0   0   0
 0   0   0   0   0   0   0   0   0   0
5.2-8              2N  4W  1 -8501.0      34.67      97.57
5.               USGD-FLORES NDE          WILDCAT      6803280KLAHOMA    STEPHENS
 5.                   0.00    4.00SLNDENDE
10.                   4.00   16.00SSNDENDE
15.                  16.00   36.00SLNDENDE
20.                  36.00   53.00SSNDENDE
25.                  53.00   59.00SLNDENDE
30.                  59.00   64.00SSNDENDE
35.                  64.00   67.00SLNDENDE
40.                  67.00   71.00SSNDENDE
45.                  71.00   85.00SLNDENDE
50.                  85.00   89.00SSNDENDE
55.                  89.00  102.00SLNDENDE
60.                 102.00  141.00SSNDENDE
65.                 141.00  148.00SLNDENDE
70.                 148.00  161.00SSNDENDE
75.                 161.00  169.00SLNDENDE
80.                 169.00  172.00SSNDENDE
85.                 172.00  180.00SLNDENDE
90.                 180.00  184.00SSNDENDE
95.                 184.00  188.00SLNDENDE
100.                188.00  194.00SSNDENDE
105.                194.00  196.00SLNDENDE
110.                196.00  231.00SSNDENDE
115.                231.00  258.00SLNDENDE                     INBD
```

Figure 1.-- The ANYNAME file, as produced by STRATFE. The three data point identifiers are circled.

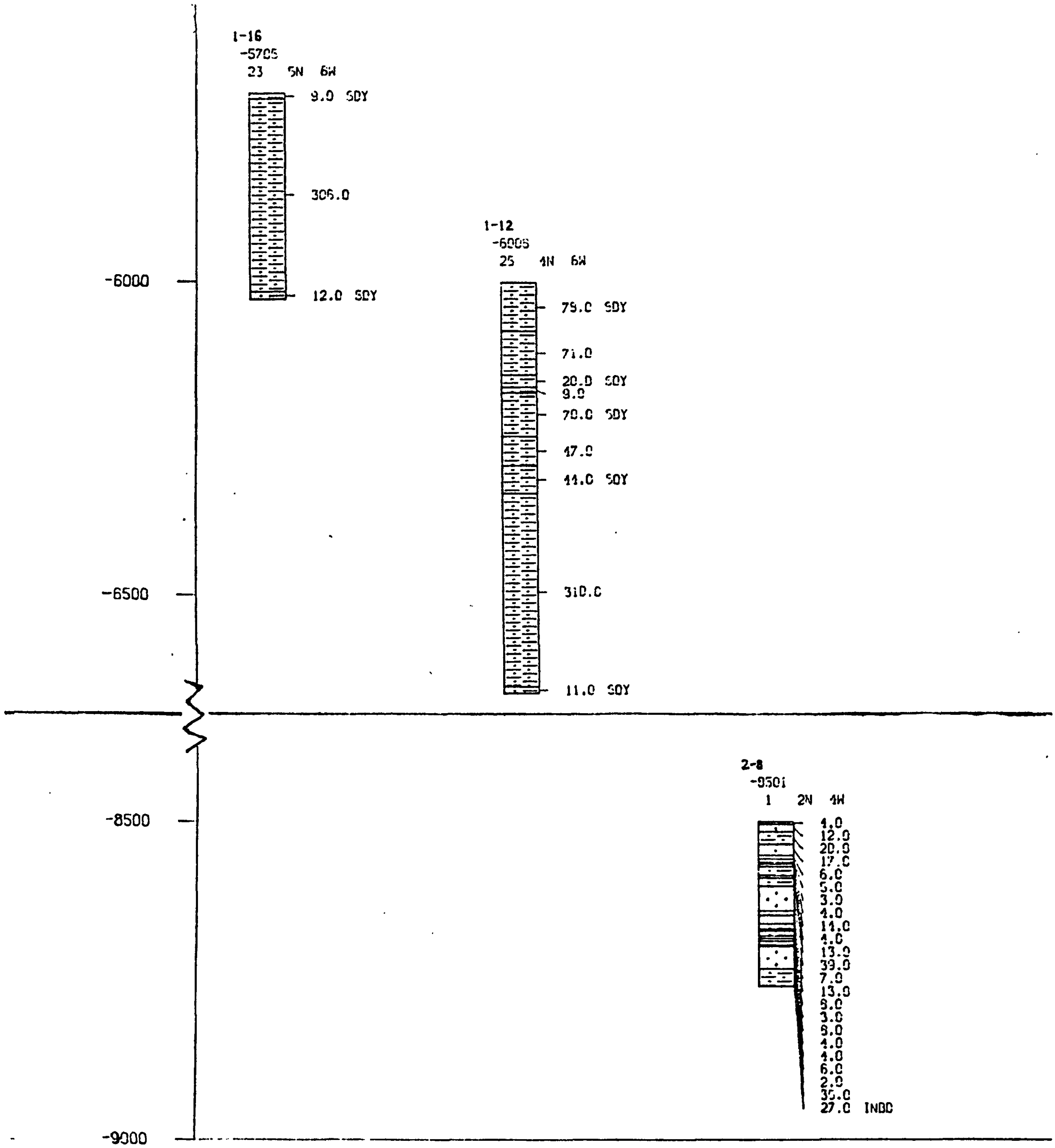


Figure 2.-- Part of the STRATS plot generated from the ANYNAME file. Datum is elevation in feet below sea level. Note gap in elevation in mid-plot. Lithologic symbols are explained in Set A of figure 3.

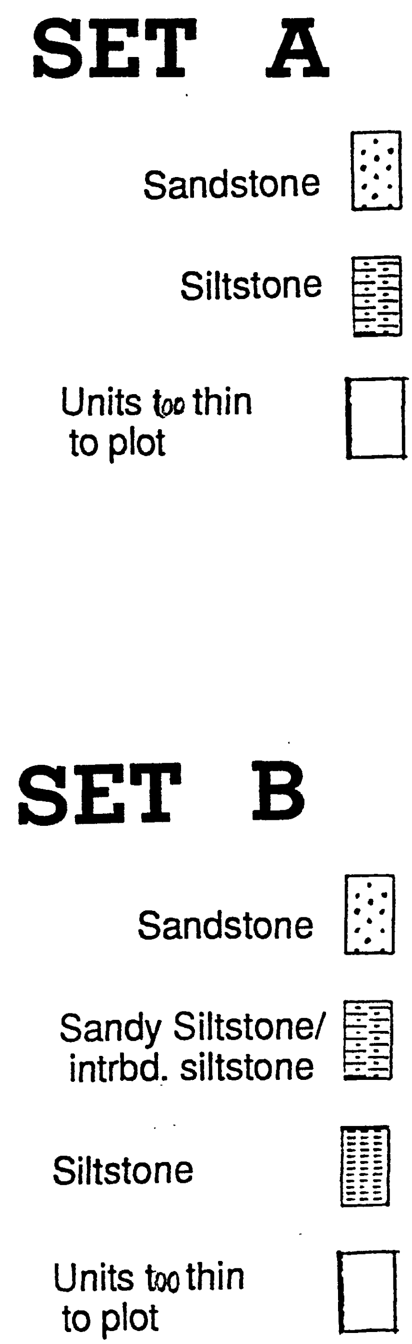


Figure 3.-- Author-drafted and annotated explanation to accompany STRATS plots. Note increase in number of symbols in Set B, and added ability to distinguish sandy or interbedded siltstone from [plain] siltstone. Set A is the explanation for figures 2 and 5; Set B is the explanation for figure 7.

generated from this unedited version of the ANYNAME file.

To add formation names, first copy the ANYNAME file; we'll call the copy FM-NAME. Then edit this FM-NAME file, as illustrated below, to introduce formation names where the bednames would have appeared. (Consult a listing of the PACER data file, or an LSTRATUS printout of the PACER data file, to determine which formations are encountered in these drill holes). We can edit the FM-NAME file so that each stratigraphic unit carries a formation name, or we can enter formation names at only selected stratigraphic units of each formation. We chose to enter formation names at only the first stratigraphic unit of each formation, to create a less cluttered plot. The edited file is shown in figure 4; it was used to produce the plot in figure 5.

For example, the first stratigraphic unit in drill hole 1-12 is displayed in the unedited FM-NAME file [which is the same as the ANYNAME file, (fig. 1)] as follows:

```
5.                  0.00   78.00SLNDENDE                  SDY
```

From our PACER data file we know that this unit is the first unit in the Morrow Formation. Using the Prime line editor, we edit the first unit as follows [the carat (^) symbol represents blank spaces]:

```
CHANGE/NDENDE^^^/MORMORROW/
```

The edited line becomes:

```
5.                  0.00   78.00SLMORMORROW               SDY
```

The format of the formation name (see fig. 4) in the FM-NAME file is the same as that of the bedname: the first three characters of the name followed by a maximum of eight characters, to more fully represent the name.

We know also from the PACER file that the last unit of drill hole 1-12 is the top unit of the Springer Formation. Again, we edit as follows:

```
45.               649.00  660.00SLNDENDE                  SDY

CHANGE/NDENDE^^^^^/SPRSPRINGER/
```

resulting in:

```
45.               649.00  660.00SLSPRSPRINGER             SDY
```

Now, when this edited version of the FM-NAME file is used as input to STRATS and the bedname option is chosen, the first unit of drill hole 1-12 will have MORROW printed in the center of the unit to the right of the thickness, and the last unit will

```
  1    1    0    9    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
 5.1-12              4N   6W 25 -6008.C       34.79      97.79
 5.                USGD-FLORES NDE            PLEASANT  VIE771002CKLAHCMA     GRADY
  5.                    0.CO    78.00SLMORMORROW                    SDY
 10.                   78.CO   149.00SLNCENCE
 15.                  149.CO   169.00SLNDENDE                       SDY
 20.                  169.CO   178.00SLNDENDE
 25.                  178.CO   248.00SLNDENCE                       SDY
 30.                  248.CO   295.00SLNCENCE
 35.                  295.CO   339.00SLNCENDE                       SDY
 40.                  339.CO   649.00SLNCENDE
 45.                  649.CO   660.00SLSPRSPRINGER                  SDY
  1    1    0    3    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
 5.1-16              5N   6W 23 -5705.C       34.98      97.7C
 5.                USGD-FLORES NDE            N. CHITWOOD 6401060KLAHOMA      GRADY
  5.                    0.CO     9.00SLMORMORROW                    SDY
 10.                    9.CO   315.00SLNCENDE
 15.                  315.CO   327.00SLSPRSPRINGER                  SDY
  1    1    0   23    0    0    0    0    0    0
  0    C    0    0    0    0    0    0    0    0
 5.2-8               2N   4W  1 -8501.0       34.67      97.57
 5.                USGD-FLORES NDE            WILDCAT      68C328OKLAHCMA     STEPHENS
  5.                    0.CO     4.00SLMORMORROW
 10.                    4.CO    16.00SSNCENDE
 15.                   16.00    36.00SLNDENCE
 20.                   36.CO    53.00SSNDENDE
 25.                   53.CO    59.00SLNCENDE
 30.                   59.CO    64.00SSNDENDE
 35.                   64.CO    67.00SLNDENDE
 40.                   67.CO    71.00SSNDENDE
 45.                   71.CO    85.00SLNCENDE
 50.                   85.CO    89.COSSNDENDE
 55.                   89.CO   102.00SLNDENCE
 60.                  102.CO   141.00SSNDENDE
 65.                  141.CO   148.COSLNCENCE
 70.                  148.CO   161.00SSNCENCE
 75.                  161.CO   169.00SLNDENDE
 80.                  169.CO   172.00SSNDENDE
 85.                  172.CO   180.COSLNDENDE
 90.                  180.CO   184.00SSNCENCE
 95.                  184.CO   188.00SLNCENCE
100.                  188.CO   194.00SSNDENDE
105.                  194.CO   196.00SLNDENCE
110.                  196.CO   231.00SSNDENCE
115.                  231.CO   258.COSLSPRSPRINGER                  INBD
```

Figure 4. -- The FM-NAME file after editing to show formation names at first stratigraphic unit of each formation.

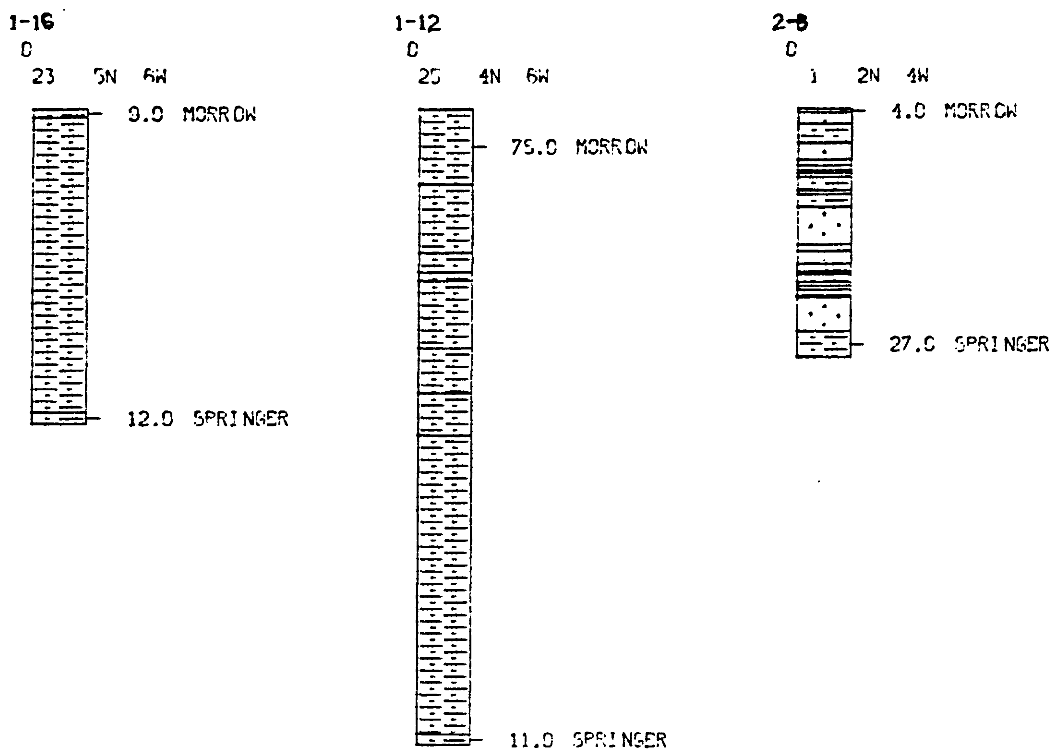


Figure 5. -- Part of the STRATS plot generated from edited **FM-NAME** file. Datum is top of the Morrow Formation. Lithologic symbols are explained in Set A of figure 3.

have SPRINGER printed in a corresponding position (see fig. 5). [Thicknesses are automatically displayed in the STRATS option that displays the bedname field.] If all the drill holes selected for a plot contain a Morrow unit, then the Morrow Formation can be used as the datum for the plot. In the example shown in figure 5, the top of the Morrow Formation was used as the datum.

When you edit the **FM-NAME** file, it is important to adjust blank spaces so that data fields remain in their correct positions. For example, if the three blank spaces after NDENDE had not been included in the CHANGE statement for the first unit, the SDY lithology modifier would have been shifted three spaces to the right.

## II. TO INCREASE THE VARIETY OF LITHOLOGIC SYMBOLS

A close examination of drill holes 1-16 and 1-12 in figure 5 shows that only one lithologic symbol, the siltstone symbol, is used in each drill hole. Figure 2 and the **ANYNAME** or **FM-NAME** files show that there are differences between the units, however. Some are [plain] siltstone and some are sandy siltstone; that is, the **primary lithology** "siltstone" with the **lithology modifier** "sandy" (SDY). STRATS displays the primary lithology in graphic symbols within the stratigraphic column and provides an option in which the lithology modifier is written to the right of the unit (see fig. 2). This option was not chosen in figure 5, however, because we chose the option to display the bedname [actually, formation name] to the right of the unit, and we cannot then also display the lithology modifier.

So how can we distinguish graphically between units with identical primary lithologies but varying lithology modifiers?

One way to do this is to represent a primary lithology and modifier with a symbol that is not otherwise used within that data set-- thus, to redefine one of the other lithologic symbols (Boger, 1986, table 1, p. 8) available in STRATS. For instance, the claystone symbol is not used in this data set of three logs. Therefore we can redefine the claystone symbol to represent one of the two siltstone types -- for instance, [plain] siltstone -- and we can leave the sandy siltstone units (and the one interbedded siltstone unit) represented by the default siltstone pattern. [We just as easily could have used the claystone symbol to represent the sandy or interbedded siltstone units and left the default pattern to represent the [plain] siltstone units.]

There are several steps to this process:

1. Make a copy of the **FM-NAME** file. We will call it **SYMNAME**, to represent the new symbols that we will use.

2. Look through the file and list the various combinations of lithology, formation, and lithology modifier.

In our file we have the following seven combinations:

```
SLMORMORROW
SLMORMORROW          SDY
SLNDENDE
SLNDENDE             SDY
SLSPRSPRINGER        SDY
SLSPRSPRINGER        INBD
SSNDENDE
```

3. Decide which lithologies to change based upon the sequence of stratigraphic units and the number of unused symbols.

   In this case, because there is just one sandstone type, we do not have any confusion with the use of that symbol. However, there are three siltstone types--sandy siltstone, interbedded siltstone, and [plain] siltstone. Because plain and sandy siltstone units alternate within this data set, it would be useful to distinguish between them graphically. We chose to use the clay symbol to represent plain siltstone. Sandy or interbedded siltstone will still be represented by the default siltstone pattern.

4. Make global changes in the **SYMNAME** file by using the CHANGE command (abbreviated as "C") in ED, the Prime text editor.

   In this case, the changes that we need are:

```
C/SLNDENDE^^^^^^^^^^^^^^^^^^^^^^/CLNDENDE/G99
C/SLMORMORROW^^^^^^^^^^^^^^^^^^^/CLMORMORROW/G99
```

   These two changes produce a file (figure 6) in which all the siltstones with no lithology modifier are changed to claystone units, and thus are represented by the claystone symbol.

   The blank spaces (^) are very important in the CHANGE statement. If we simply change all SLNDENDE to CLNDENDE, we are not creating a graphical difference among the three types of siltstone. So, only certain siltstone units should be changed to the claystone symbol-- in this example, the plain siltstone. Thus we see the 22 blank spaces after the SLNDENDE in the CHANGE statement; these spaces represent the absence of a lithology modifier.

```
  1    1    0    9    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
 5.1-12              4N   6W 25 -6008.0      34.79      97.79
 5.                USGD-FLORES NDE          PLEASANT VIE7710020KLAHOMA     GRADY
  5.                  0.00    78.00SLMORMORROW                SDY
 10.                 78.00   149.00CLNDENDE
 15.                149.00   169.00SLNDENDE                   SDY
 20.                169.00   178.00CLNDENDE
 25.                178.00   248.00SLNDENDE                   SDY
 30.                248.00   295.00CLNDENDE
 35.                295.00   339.00SLNDENDE                   SDY
 40.                339.00   649.00CLNDENDE
 45.                649.00   660.00SLSPRSPRINGER              SDY
  1    1    0    3    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
 5.1-16              5N   6W 23 -5705.0      34.98      97.70
 5.                USGD-FLORES NDE          N. CHITWOOD 6401060KLAHOMA     GRADY
  5.                  0.00     9.00SLMORMORROW                SDY
 10.                  9.00   315.00CLNDENDE
 15.                315.00   327.00SLSPRSPRINGER              SDY
  1    1    0   23    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
 5.2-8               2N   4W  1 -8501.0      34.67      97.57
 5.                USGD-FLORES NDE          WILDCAT      6803280KLAHOMA    STEPHENS
  5.                  0.00     4.00CLMORMORROW
 10.                  4.00    16.00SSNDENDE
 15.                 16.00    36.00CLNDENDE
 20.                 36.00    53.00SSNDENDE
 25.                 53.00    59.00CLNDENDE
 30.                 59.00    64.00SSNDENDE
 35.                 64.00    67.00CLNDENDE
 40.                 67.00    71.00SSNDENDE
 45.                 71.00    85.00CLNDENDE
 50.                 85.00    89.00SSNDENDE
 55.                 89.00   102.00CLNDENDE
 60.                102.00   141.00SSNDENDE
 65.                141.00   148.00CLNDENDE
 70.                148.00   161.00SSNDENDE
 75.                161.00   169.00CLNDENDE
 80.                169.00   172.00SSNDENDE
 85.                172.00   180.00CLNDENDE
 90.                180.00   184.00SSNDENDE
 95.                184.00   188.00CLNDENDE
100.                188.00   194.00SSNDENDE
105.                194.00   196.00CLNDENDE
110.                196.00   231.00SSNDENDE
115.                231.00   258.00SLSPRSPRINGER              INBD
```

Figure 6.-- The SYMNAME file after editing to show all [plain] siltstone lithologies as claystones (CL).

5. Run STRATS with the edited **SYMNAME** file as the input database. Figure 7 shows part of the resulting STRATS plot. In the plot explanation (see fig. 3), indicate that the default siltstone symbol represents sandy or interbedded siltstone, and the claystone symbol represents [plain] siltstone.

There are two conditions under which this method will not work. One is when there are no unused lithologic symbols. The other is when the change of lithologic symbol will be too confusing to the users of the STRATS plot. This occurs when a lithologic symbol which typically represents a specific rock type, such as the limestone symbol, would be used to represent a rock type with little association with limestone, such as silty sandstone. Even though the limestone symbol would be clearly redefined by the author in the plot explanation, it still may be unrealistic to expect readers to disassociate the limestone symbol from its usual meaning. In our substitution above, we felt that use of the claystone symbol to represent siltstone would not be confusing, if such a usage was clearly shown in the plot explanation.

In those instances when symbols cannot be substituted, color can be used to distinguish between similar lithologic types. For instance, [plain] siltstone units can be left uncolored, while sandy siltstone units can be colored beige. The color would be applied by hand, after the STRATS plot is generated, and the colored symbol(s) should be added to the plot explanation.

## III. TO DISPLAY PARTIAL STRATIGRAPHIC SEQUENCES
### A) PARTIAL DRILL HOLES

When data from drill holes are entered into the computer, we often include all or most of the length of the hole. However, only parts of the hole may contain data of immediate interest. It is an advantage to be able to isolate a particular formation within the hole and display its units in more detail. The STRATFE[1] program, at this time, cannot run on a PACER file unless the first unit of the file has a FROM depth value of 0.00. Therefore, the PACER file must be edited so that the first unit of interest is at the top of the file.

**Preparing the PACER file** - The data for this exercise are stored in the NCRDS in three drill holes. Each hole consists of about 5000 feet of stratigraphic section contained in eight geologic formations. We want to display only about 500 feet of section in

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[1]A new version of STRATFE will allow the first FROM value to be greater than 0.0 and will allow the first unit number to be greater than 1. This version is currently being tested.

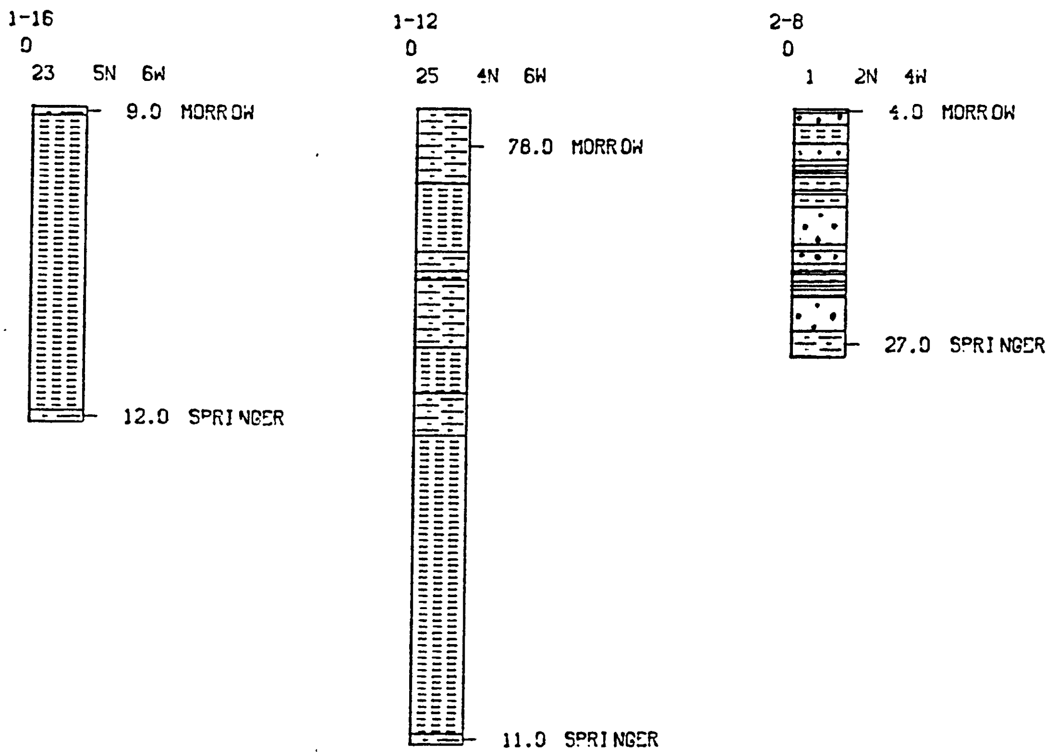


Figure 7.-- Part of the STRATS plot generated from the edited **SYMNAME** file. Datum is top of the Morrow Formation. Lithologic symbols are explained in Set B of figure 3.

two formations. Figure 8 shows the original drill hole data as stored in the database and that portion of the original drill hole that we want to graphically display using STRATS. Following is a sequence of steps to extract this subset of data:

1. Search the original PACER file for all the formations **above and including** the formations of interest. In this case we will search using the conditions:

   A. FORMATN EQ KIRTLAND
   B. FORMATN EQ FRUITLAND
   C. FORMATN EQ PICTURED CLIFFS

   The logic for this search is A .or. B .or. C. We will name the output file from this search <u>TOPFORMS</u>.

2. Search <u>TOPFORMS</u> for the formations **above** the two formations you wish to display. In this case the condition of the search is

   A. FORMATN EQ KIRTLAND

   We will call the output file for this search <u>ABOVEFM</u>.

3. Use PACER's update procedure 4 (batch update) to change all thickness values in the <u>ABOVEFM</u> file to 0.01 feet. Post the <u>ABOVEFM</u> file back to the <u>TOPFORMS</u> file. [For details on the PACER update procedures, see Biewick and others, (1986)]. The reason for this step is to reduce to zero the thickness of all the units above the units you wish to display. Thickness data in the NCRDS are stored in inches, so as a result of the update procedure, 0.01 ft is converted to 0.0008 in. In the STRATFE program, inches are converted back to feet, but because STRATFE does not read beyond the second number after the decimal, the 0.0008 in. is read as 0.00 in. and is converted to 0.00 ft.

4. Exit PACER. Run the STRATTHK program on the <u>TOPFORMS</u> file. This is a crucial step! By running STRATTHK, the FROM and TO values in <u>TOPFORMS</u> will be changed to agree with the thickness values that you just entered during PACER's update procedure.

5. Run STRATFE using the <u>TOPFORMS</u> file. We'll call the output from STRATFE <u>ANYNAME.</u> STRATFE reads FROM and TO values within the PACER file when creating the <u>ANYNAME</u> file for input into STRATS.

**Preparing the <u>ANYNAME</u> file** - Figure 9 shows the contents of the <u>ANYNAME</u> file. Notice that several of the units at and near the top of each data point have both a FROM and TO value of 0.00. After making a backup copy of <u>ANYNAME</u> file, use the Prime editor to delete each line in the <u>ANYNAME</u> file where the unit has both FROM <u>and</u> TO values of 0.00. The unit with the first TO value

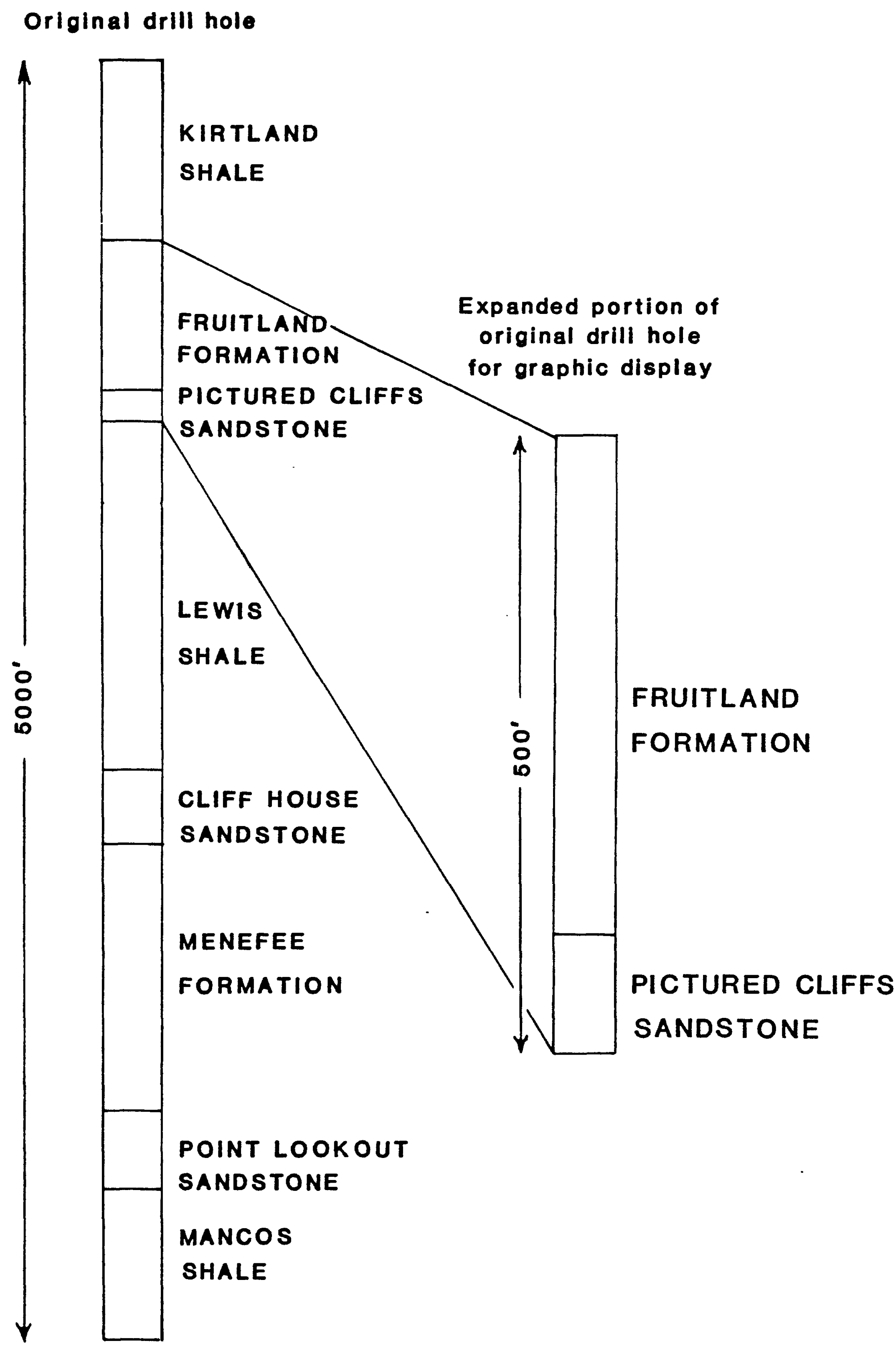


Figure 8.-- Schematic diagram showing the stratigraphic sequence of rock units as originally entered into the database (left) and that portion of the original sequence that we want to display (right). Not drawn to scale.

```
 1    1    0  (20)  0    0    0    0    0    0
 0    0    0    0   0    0    0    0    0    0
5.21992          31N 14W 24  5705.0   36.8833770  108.2535095
5.              USGO-RCBINSOPURGATORY CANDE        76C409NEW MEXICO  SAN JUAN
 5.                 0.00     0.00NRNDENDE
10.                 0.00     0.00SHNDENDE
15.                 0.00     0.00SSNDENDE
20.                 0.00     0.00SLNDENDE
25.                 0.00     0.00SHNDENDE
30.                 0.00    48.00SLNDENDE
35.                48.00    87.00SHNDENDE
40.                87.00    92.00COLOCLCCAL1
45.                92.00   140.00SHNDENDE
50.               140.00   142.00CONDENDE
55.               142.00   225.00SLNDENDE
60.               225.00   237.00SHNDENDE
65.               237.00   239.00COUTEUTE CANYON
70.               239.00   242.00SHNDENDE
75.               242.00   249.00COUTEUTE CANYON
80.               249.00   286.00SSNDENDE
85.               286.00   318.00SHNDENDE
90.               318.00   322.00COMAIMAIN
95.               322.00   335.00SHNDENDE
100.              335.00   351.00SSNDENDE
 1    1    0  (12)  0    0    0    0    0    0
 0    0    0    0   0    0    0    0    0    0
5.21993          31N 14W 25  5688.0   36.8746109  108.2539368
5.              USGO-RCBINSOYOUNGS LAKE NDE        760425NEW MEXICO  SAN JUAN
 5.                 0.00     0.00NRNDENDE
10.                 0.00     0.00SHNDENDE
15.                 0.00    59.00SLNDENDE
20.                59.00    64.00COLCCLOCAL1
25.                64.00    91.00SSNDENDE
30.                91.00   245.00SLNDENDE
35.               245.00   249.00COUTEUTE CANYON
40.               249.00   250.00SHNDENDE
45.               250.00   255.00COUTEUTE CANYON
50.               255.00   342.00SLNDENDE
55.               342.00   347.00COMAIMAIN
60.               347.00   363.00SSNDENDE
 1    1    0  (28)  0    0    0    0    0    0
 0    0    0    0   0    0    0    0    0    0
5.21999          31N 14W 13  5681.0   36.8959121  108.2518158
5.              USGO-RCBINSOPURGATORY CANDE        76C319NEW MEXICO  SAN JUAN
 5.                 0.00     0.00NRNDENDE
10.                 0.00     0.00SHNDENDE
15.                 0.00     0.00SSNDENDE
20.                 0.00     0.00SHNDENDE
25.                 0.00    30.00SSNDENDE
30.                30.00    37.00SHNDENDE
35.                37.00    54.00SSNDENDE
40.                54.00    62.00SHNDENDE
45.                62.00    64.00CONDENDE
50.                64.00    82.00SHNDENDE
55.                82.00   100.00SSNDENDE
60.               100.00   145.00SHNDENDE
65.               145.00   146.00COLCCLOCAL1
70.               146.00   150.00SHNDENDE
75.               150.00   155.00COLCCLCCAL1
80.               155.00   259.00SHNDENDE
85.               259.00   280.00SSNDENDE
90.               280.00   286.00SHNDENDE
95.               286.00   290.00COUTEUTE CANYON
100.              290.00   293.00SHNDENDE
105.              293.00   302.00COUTEUTE CANYON
110.              302.00   318.00SHNDENDE
115.              318.00   350.00SSNDENDE
120.              350.00   361.00SHNDENDE
125.              361.00   365.00SLNDENDE
130.              365.00   374.00COMAIMAIN
135.              374.00   380.00SHNDENDE
140.              380.00   396.00SSNDENDE
```

Figure 9.-- The ANYNAME file after updating in PACER showing FROM and TO values of 0.00 for units above those of interest. The number of units for each data point is circled.

greater than zero is your new unit 1.

The first line in the **ANYNAME** file consists of numbers separated by spaces. The fourth number in this line represents the number of units that the STRATS program expects to encounter in a particular drill hole (fig. 9). Use the Prime editor to change this number to agree with the number of units remaining after deletions. The STRATS program cannot run successfully if the number of units shown in the first line of the header for each drill hole does not match the actual number of units listed. When you change the number of units in the header, remember to adjust blank spaces so that the number remains in the correct position on the line. Figure 10 is the contents of the **ANYNAME** file after editing.

Run the STRATS program using this edited **ANYNAME** file as the input file. Figure 11 shows the graphic output from STRATS under the option to display no annotation. Note that this version of the **ANYNAME** file does not contain formation names: they can be added to the file using the procedure described in the first part of this report.

## B) MEASURED COAL SECTIONS

Data entered into the computer from stratigraphic sections measured on the outcrop may include several coal beds, correlated and named, in a stratigraphic interval of several hundred feet. It is often desirable to display only that part of the measured section that consists of the roof rock, a particular coal bed with its parting(s), and the floor rock. The output that we want from STRATS is a graphic display of a correlated coal bed from several different measured sections, aligned at the top of either the coal bed or the roof rock.

Update the PACER file (we'll call this file **MEASEC**) as in the previous example so that units above the units you wish to display have a 0.01 ft thickness. You may want to display only part of the roof and floor rock (by decreasing the thickness value through update procedure 3 in PACER) so that the diagram appears balanced. Do not be concerned with units below those you want to show, as they can easily be deleted from the STRATFE output file (**ANYNAME** file).

Use the update procedure 4 in PACER to change the surface elevations of the coal sections in the **MEASEC** file to 0.0. Exit PACER and run the STRATTHK program so the FROM and TO values for each unit will agree with the updates you made to the thicknesses of each unit. Run STRATFE using **MEASEC** as the input file and **ANYNAME2** as the output file. As described in the previous exercise for partial drill holes, edit the **ANYNAME2** file by deleting units that have both FROM and TO values equal to 0.00. At this point you can also delete any unwanted units below the units you wish to display. Once again, be sure to make the number of units (the fourth number in the first line of each data point) match the actual number of units listed.

Run STRATS using **ANYNAME2** as the input file. Choose the option to plot the sections using elevation as the datum, so the tops of the measured coal sections will be aligned. Figure 12 is the graphic output from this exercise.

```
  1    1    0   15    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
 5.21992            31N 14W 24   5705.0    36.8833770   108.2535095
 5.               USGD-RCBINSOPURGATORY CANDE           760409NEW MEXICO   SAN JUAN
 30.                   0.00    48.00SLNDENDE
 35.                  48.00    87.00SHNDENDE
 40.                  87.00    92.00CLOCLOCAL1
 45.                  92.00   140.00SHNDENDE
 50.                 140.00   142.00CONDENDE
 55.                 142.00   225.00SLNDENDE
 60.                 225.00   237.00SHNDENDE
 65.                 237.00   239.00COUTEUTE CANYON
 70.                 239.00   242.00SHNDENDE
 75.                 242.00   249.00COUTEUTE CANYON
 80.                 249.00   286.00SSNDENDE
 85.                 286.00   318.00SHNDENDE
 90.                 318.00   322.00COMAIMAIN
 95.                 322.00   335.00SHNDENDE
100.                 335.00   351.00SSKPCKPC
  1    1    0   10    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
 5.21993            31N 14W 25   5688.0    36.8746109   108.2539368
 5.               USGD-RCBINSOYOUNGS LAKE NDE           760425NEW MEXICO   SAN JUAN
 15.                   0.00    59.00SLNDENDE
 20.                  59.00    64.00COLOCLOCAL1
 25.                  64.00    91.00SSNDENDE
 30.                  91.00   245.00SLNDENDE
 35.                 245.00   249.00COUTEUTE CANYON
 40.                 249.00   250.00SHNDENDE
 45.                 250.00   255.00COUTEUTE CANYON
 50.                 255.00   342.00SLNDENDE
 55.                 342.00   347.00COMAIMAIN
 60.                 347.00   363.00SSKPCKPC
  1    1    0   24    0    0    0    0    0    0
  0    0    0    0    0    0    0    0    0    0
 5.21999            31N 14W 13   5681.0    36.8959121   108.2518158
 5.               USGD-RCBINSOPURGATORY CANDE           760319NEW MEXICO   SAN JUAN
 25.                   0.00    30.00SSNDENDE
 30.                  30.00    37.00SHNDENDE
 35.                  37.00    54.00SSNDENDE
 40.                  54.00    62.00SHNDENDE
 45.                  62.00    64.00CONDENDE
 50.                  64.00    82.00SHNDENDE
 55.                  82.00   100.00SSNDENDE
 60.                 100.00   145.00SHNDENDE
 65.                 145.00   146.00CLOCLOCAL1
 70.                 146.00   150.00SHNDENDE
 75.                 150.00   155.00COLOCLOCAL1
 80.                 155.00   259.00SHNDENDE
 85.                 259.00   280.00SSNDENDE
 90.                 280.00   286.00SHNDENDE
 95.                 286.00   290.00COUTEUTE CANYON
100.                 290.00   293.00SHNDENDE
105.                 293.00   302.00COUTEUTE CANYON
110.                 302.00   318.00SHNDENDE
115.                 318.00   350.00SSNDENDE
120.                 350.00   361.00SHNDENDE
125.                 361.00   365.00SLNDENDE
130.                 365.00   374.00COMAIMAIN
135.                 374.00   380.00SHNDENDE
140.                 380.00   396.00SSKPCKPC
```

Figure 10.-- The ANYNAME file after editing, showing new number of units for each data point (circled). This number must agree with the actual number of units listed.

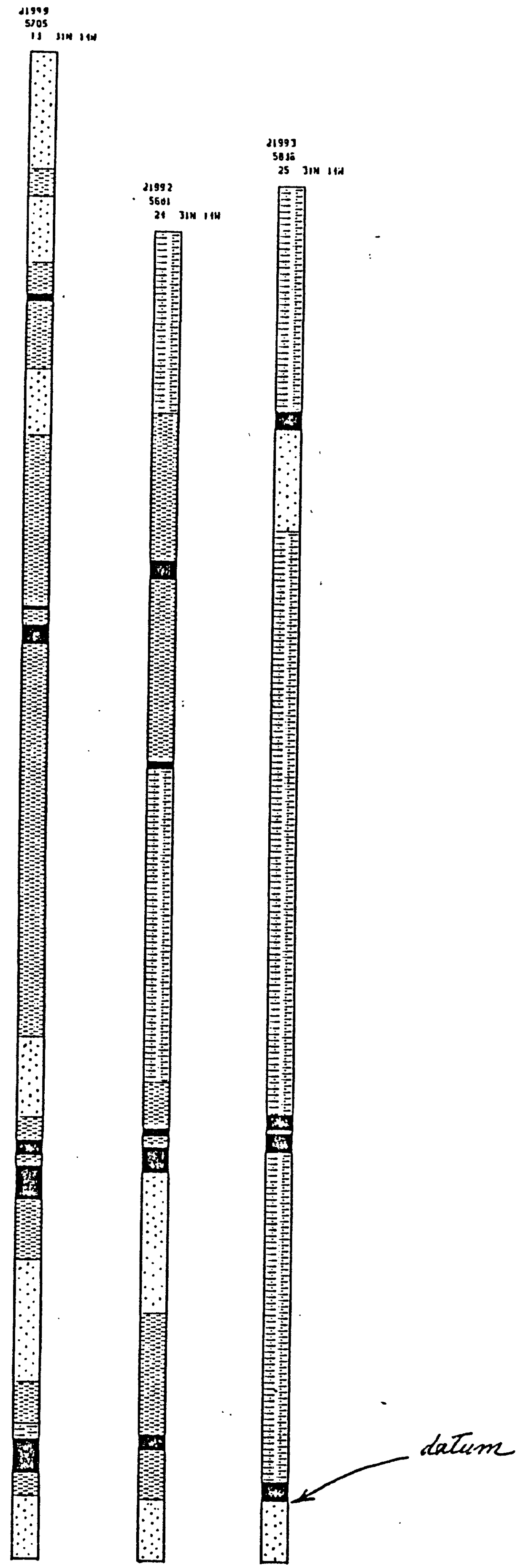


Figure 11.-- STRATS plot displaying partial drill holes (generated from edited ANYNAME file). Datum is top of Pictured Cliffs Sandstone.

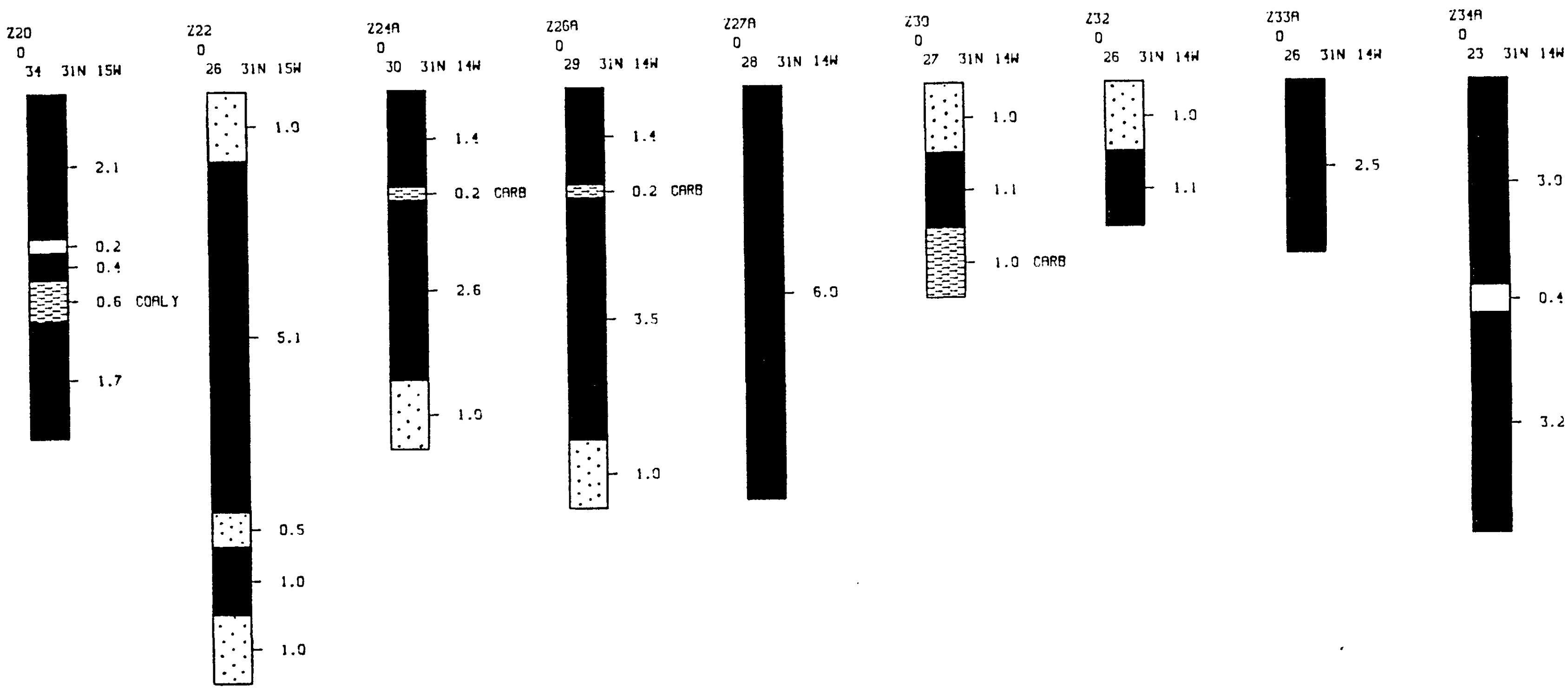


Figure 12.-- STRATS plot of correlated coal beds showing portion of roof and floor rock and partings, plotted according to elevation.

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