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# INTERPRETING SEISMIC DATA WORKBOOK

A GEOPHYSICAL COLORING BOOK

J.A. Coffeen

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# ON USING THIS BOOK

This book contains the exercises that, performed while reading *Interpreting Seismic Data*, will give you the practice necessary for a start in seismic interpretation. You will need some colored pencils, soft plastic erasers, and a few sheets of tracing paper, in addition to ordinary pencils and a ball-point or other type of pen. After completing the two books, you should be accomplished enough to interpret with some supervision. Part of your development in interpreting is in building up your confidence that you can do it well. It would be nice to get to the stage where you could say with assurance that your interpretation was correct, or that a well drilled where you recommend would produce, but you aren't going to reach that level of proficiency. I haven't, and neither have any other geophysicists.

The confidence you can build, the kind other geophysicists have, is confidence that you can interpret effectively. Interpreting effectively is a mat-

ter of developing prospects that have a good chance of having oil in them, of making interpretations that are reasonable, that may help find oil.

Of course, nothing will really give you the equivalent of years of experience but years of experience. To get all the experience you can from the exercises, you can do more interpretation than they ask you to do. For instance, you can pick extra horizons on a section. As you progress through the book, you may want to go back and do more interpreting on sections or maps provided for earlier exercises. It's your book—get all the good out of it you can.

Seismic interpretation is often difficult. But also it is usually fun. So—work—and enjoy.



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The sections and maps in this workbook are intended to be like the real things interpreters work with, including flaws. The maps have different types of patterns of seismic lines, some well-planned, others disorganized; some with a good system of line and shot point numbering, some that might have developed without planning; some of the drafting hand-lettered, some not. Most of the wells on the sections are fictitious, just put in as examples.

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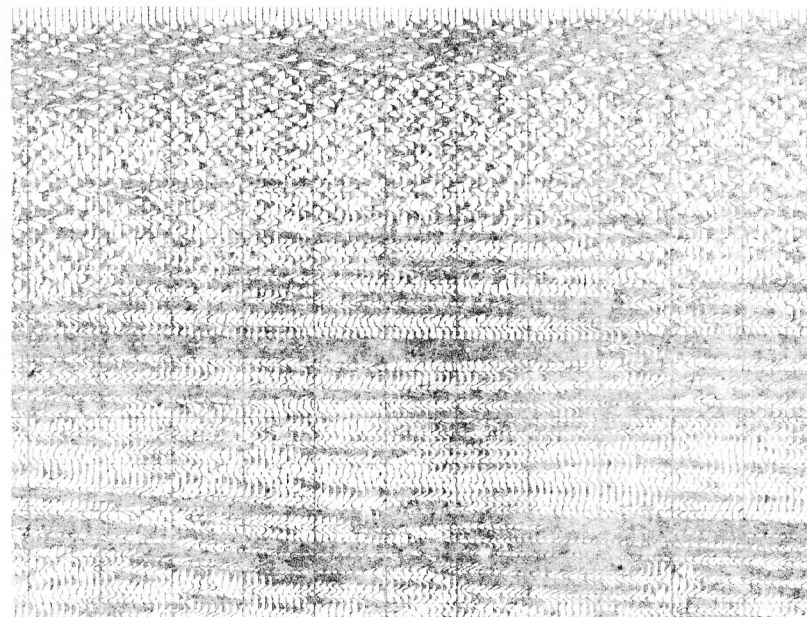
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# PART A



**START  
INTERPRETING**



## EXERCISE 1-1 THE TWO TOOLS

The exercises in this book will mostly be things for you to do—like picking, identifying, contouring—but this introductory exercise is different. It is just to give you a look at the two kinds of tools you will spend most of your time and effort on in an interpreting career.

Fig. 1-1a is a seismic section. Look it over. You may spend years looking at sections. There is high excitement in them, even though it may not be apparent at first. Neither is the excitement of deep-sea fishing apparent from the surface of the water.

Turn the page for Fig. 1-1b.

LINE 10  
AREA

CLIENT TXC NON-EXCLUSIVE  
SHOT POINTS  
LOCATION  
DIRECTION



## FIELD DATA

|                |                      |                       |
|----------------|----------------------|-----------------------|
| RECORDED BY    | TELEDYNE EXPLORATION |                       |
| DATE           | 1980                 |                       |
| INSTRUMENTS    | SPS 10               |                       |
| FILTER         | 08-124 HZ            | NO. CHANNELS 60       |
| RECORD LENGTH  | 6.0 SEC              | SAMPLE RATE 2 MS      |
| SPEED (MMPS)   | 500 FT - 18176 FT    |                       |
| S. P. INTERVAL | 92 FT                | GROUP INTERVAL 164 FT |
| EMULSION       | MULTI-EXPOSURE       |                       |
| REMARKS        |                      |                       |

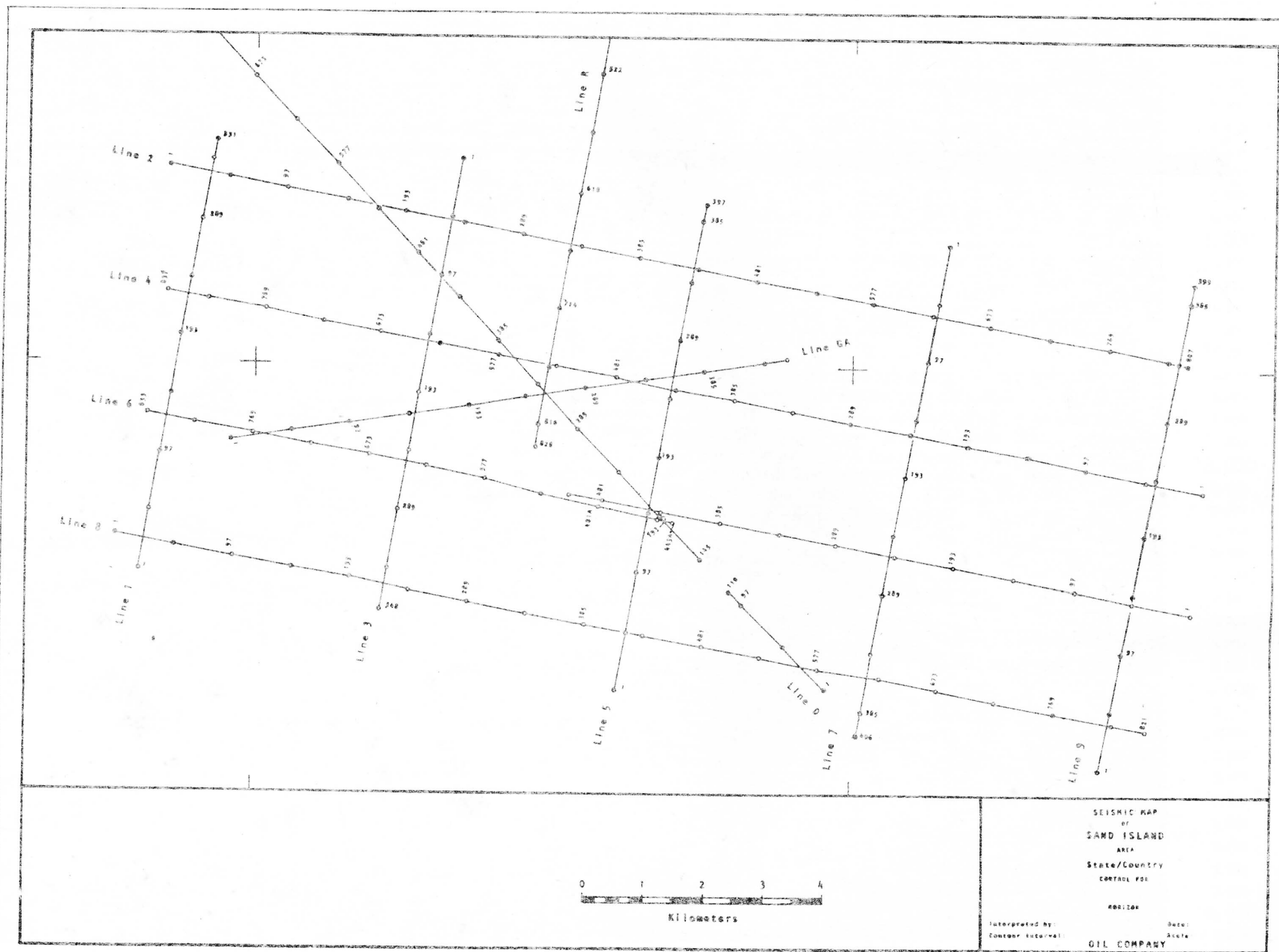
## DIGITAL PROCESSING INFORMATION

|                           |                                             |                   |
|---------------------------|---------------------------------------------|-------------------|
| DATE PROCESSED            | 1980                                        | SAMPLE RATE 4 MS  |
| DATA FILE                 | SEA LEVEL                                   |                   |
| TIME NOTES                | 0 MS SEC                                    | DISTANCE 500 FT   |
|                           | TIME 2.50 SEC                               | DISTANCE 18176 FT |
|                           |                                             | DISTANCE          |
|                           |                                             | DISTANCE          |
|                           |                                             | DISTANCE          |
| DATA ATTENUATION SEQUENCE |                                             |                   |
| 1. GAIN RECOVERY          |                                             |                   |
| 2. DIVERGENCE CORRECTION  |                                             |                   |
| 3. DECONVOLUTION          |                                             |                   |
| OPERATOR LENGTH(1)        | 252 MS                                      |                   |
| PREDICTION LENGTH(1)      | 4 MS                                        |                   |
| CORR. GATE(1)             | 0.5-3.0 SEC                                 | DISTANCE 500 FT   |
| CORR. GATE(1)             | 2.2-4.2 SEC                                 | DISTANCE 18176 FT |
| BAND LIMIT(1)             | 12-400                                      | TIME 0.0-6.0      |
| OPERATOR LENGTH(2)        |                                             |                   |
| PREDICTION LENGTH(2)      |                                             |                   |
| CORR. GATE(2)             |                                             | DISTANCE          |
| CORR. GATE(2)             |                                             | DISTANCE          |
| BAND LIMIT(2)             |                                             | TIME              |
| 5. VELOCITY ANALYSIS      |                                             |                   |
| 6. HAD                    |                                             |                   |
| 7. STACK                  |                                             | 60 FIELD CP       |
| 10. DIGITAL FILTER        |                                             |                   |
| BAND LIMIT                | 12-45                                       | TIME 0.0-6.0      |
| BAND LIMIT                | 10-40                                       | TIME 0.0-6.0      |
| BAND LIMIT                | 5-30                                        | TIME 0.0-6.0      |
| BAND LIMIT                |                                             | TIME              |
| BAND LIMIT                |                                             | TIME              |
| 8. PROGRAM GAIN           |                                             |                   |
| 9. REGISTRATION           |                                             |                   |
| 3. AMPLITUDE ENHANCEMENT  |                                             |                   |
| STRETCHING PROCESSING     |                                             |                   |
| OTHER                     |                                             |                   |
| REMARKS                   | SWEEPLET-ZERO PHASE                         |                   |
|                           | PEAK EQUALS POSITIVE REFLECTION COEFFICIENT |                   |

## DISPLAY PARAMETERS

|                   |             |            |    |
|-------------------|-------------|------------|----|
| TRACKS PER INCH   | 32          | GAIN LEVEL | 18 |
| INCHES PER SECOND | 2.5         | PERCENT WA | 10 |
| POLARITY          | 1-4-1-4-1-4 | REC. NO.   |    |

Fig. 1-1b is the second of the tools, a shot point base map. Data from sections is plotted on such maps and contoured. Picking sections and contouring maps are the main things you will do in seismic interpretation. They will provide most of your opportunities to do useful and imaginative interpreting.

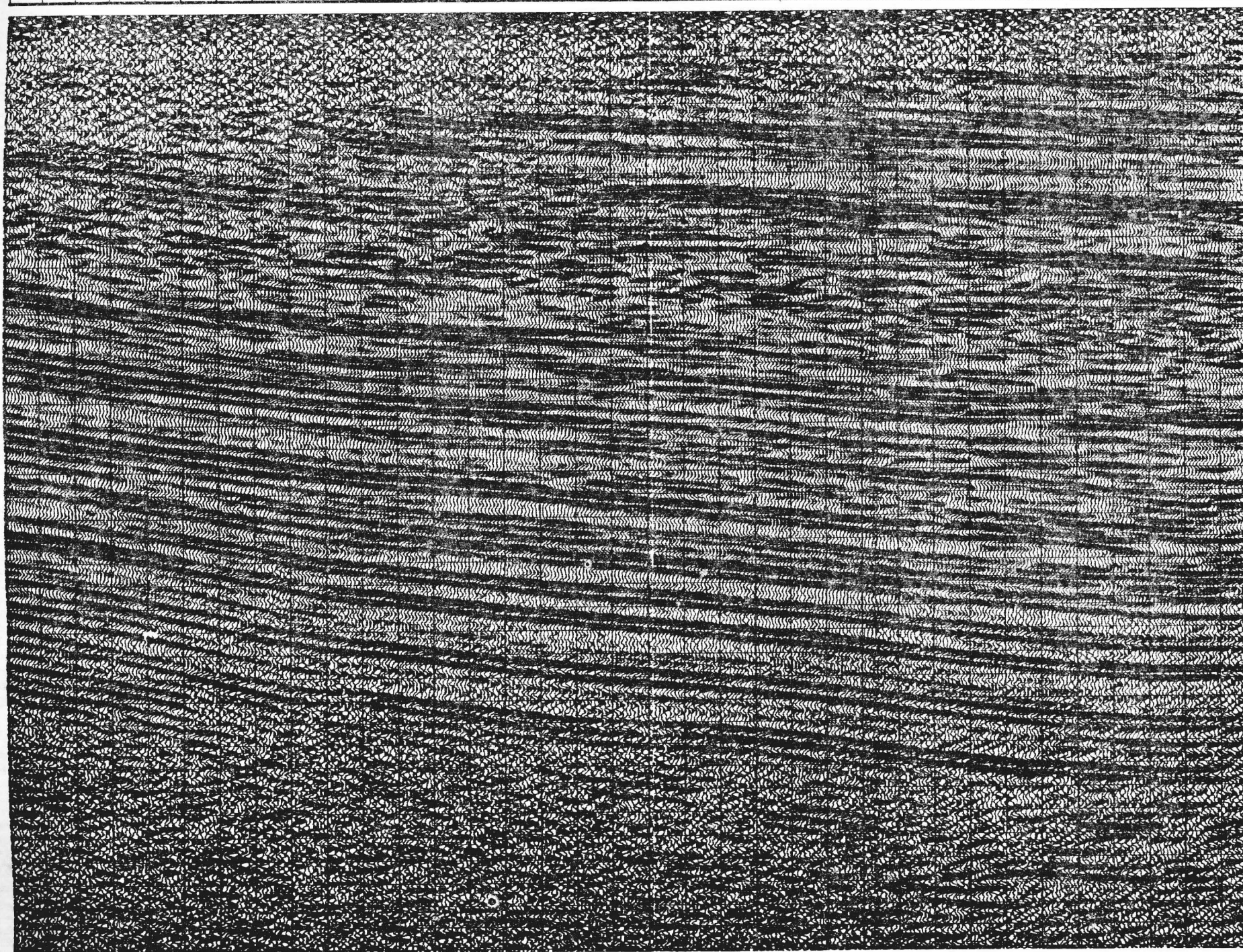


## EXERCISE 2-1 PICK A REFLECTION

This exercise is to get you started picking reflections. Look at the section in Fig. 2-1. Look first at the orientation of the section, with shot point numbers at the top and reflection times along the side. The section is made up of wiggly lines with the peaks, that is, the wiggles to the right, filled in. So reflections from continuous rock layers are seen as bands of black (the filled-in parts) alternating with lighter bands (just wiggles). Notice particularly the reflections that appear to go all the way across the section. Select one of the better ones and pick it by coloring the light-colored band, the lineup of wiggles to the left—the troughs.



470 460 450 440 430 420 410 400 390 380 370 360 350 340 330 320 310

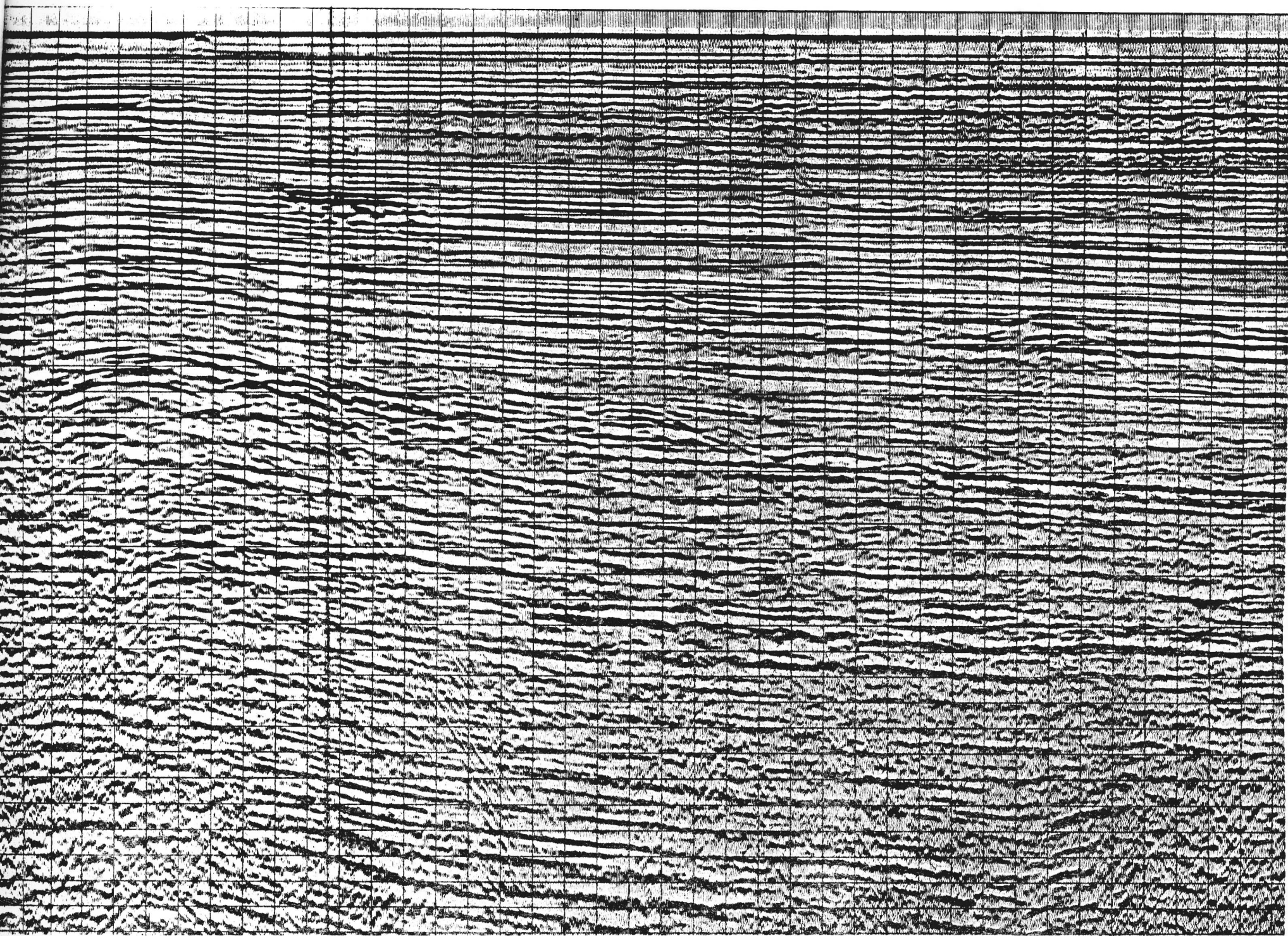


0.000  
0.100  
0.200  
0.300  
0.400  
0.500  
0.600  
0.700  
0.800  
0.900  
1.000  
1.100  
1.200  
1.300  
1.400  
1.500  
1.600  
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3.000  
3.100  
3.200  
3.300  
3.400  
3.500  
3.600  
3.700  
3.800  
3.900  
4.000  
4.100

## EXERCISE 2-2 SEVERAL REFLECTIONS

Here, in Fig. 2-2, is another section. This time, color several reflections. Again select some of the better ones. This is a standard thing to do in seismic interpretation. Even when you want to interpret a poor reflection you can do it more reliably if you have already picked some of the better reflections above and below it. If you start with the very best reflection, it will help you in picking the second best, and so on. Color three or four reflections in different colors or in plain black pencil, which also makes them stand out satisfactorily.





### EXERCISE 2-3 PHANTOM HORIZON

On the section in Fig. 2-3, a horizon is indicated by an arrow at the right side of the section. Assume that the horizon has been identified from well data at that point, and pick it across the section. There is not a continuous reflection at that level though, so you need a technique other than just marking a continuous reflection. You can make a phantom horizon by marking the bits of reflected energy above and below it and transferring their dips to the horizon you are picking. You can transfer them by reading times, or sliding two triangles, or using a transparent rule with parallel lines on it, or even by judgment alone. The rock layers themselves may not be continuous. If that is true, then your phantom horizon, as an average dip for the zone, is as continuous as anything on the section.



