SPECTRALOG: A NEW WAY TO FIND OIL

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ABSTRACT

The Spectralog is a tool that measures radioactive formations. In the past, all radioactive kicks on a conventional gamma ray have been considered shale. With this new tool, we are able to determine that these radioactive kicks are not all truly shale but formations that are oil or gas bearing in certain areas. We are able to find additional hydrocarbons that conventional logs have missed.

This paper will show many examples in which this has happened.

INTRODUCTION

The Dresser Atlas Spectralog uses a high resolution gamma spectrometer, a special calibration technique, and a computer-processed scaling and background technique.

The tool assists in the description and identification of rock types, reliable shaliness estimates based on the potassium and thorium curves, and the location of intervals to perforate and to pinpoint zones of interest.

This is a conventional gamma ray that we are taking total counts from and breaking them into three different energy levels and processing them through a multichannel analyzer to give us three different curves, for potassium, uranium, and thorium.

We know that shale is predominately potassium and thorium. Therefore, when these two curves increase in activity, we know the radioactive kick on the gamma ray is shale. When the potassium and thorium is low but the uranium is high, then the radioactive kick is not shale. It is in these areas that we look for hydrocarbons. The theory behind this is that uranium is soluble in fluid and has migrated through these formations in the past and deposited uranium on the formation, which indicates permeability and/or fracturing.

Figure 1 shows the schematics of the tool and panel. Also, the energy window calibration is shown. This figure shows the three energy levels that we are picking to get potassium, uranium, and thorium.

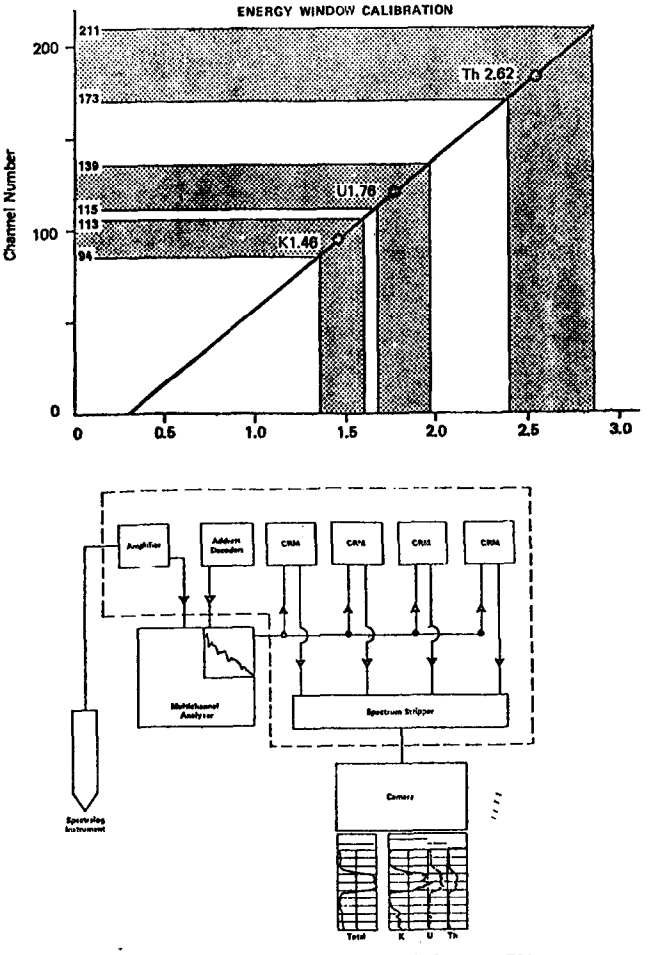

FIGURE 1—GAMMA RAY ENERGY - MEV

Figure 2 shows the four curves presented on the Spectralog. On the left side is the conventional gamma ray with total counts. This total count is broken down into the three different energy levels of potassium, uranium, and thorium. This figure shows what shale looks like on the log indicating a high potassium and increased thorium content.

Figure 3 shows a number of radioactive kicks on the gamma ray, but the potassium curve shows that there are intervals where the potassium and thorium is low but the uranium is high. These intervals are not shale but a radioactive formation that should be inspected.

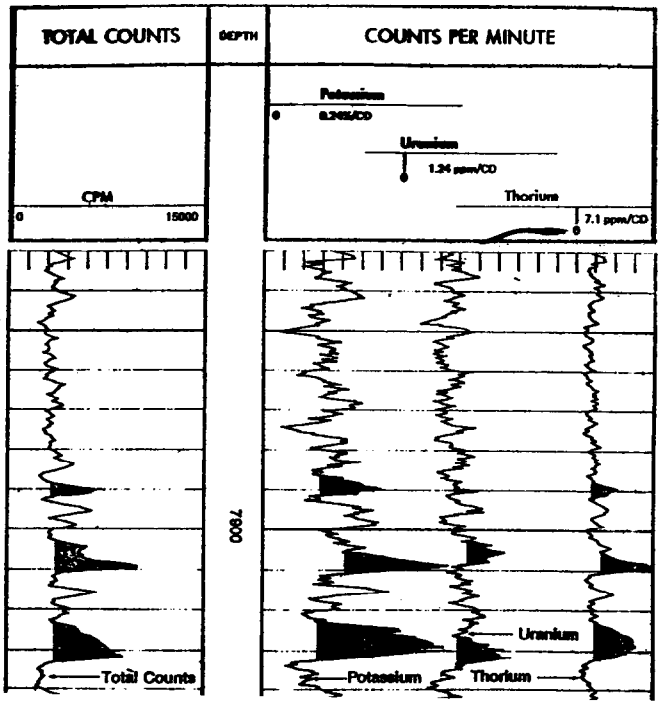

FIGURE 2—SCHEMATIC OF THE SPECTRALOG INSTRUMENTATION

We see in Figure 4 a well in Hockley County, Texas, that is in the Clearfork formation. Texas American used to perforate the porous intervals only until they ran the Spectralog. The dotted curve is the Compensated Neutron and the perforations at 6220 ft, 6225 ft, 6256 ft, 6265 ft, 6285 ft, 6292 ft, and 6304 ft are from the neutron. The additional perforations are from the Spectralog. This well has increased in production substantially.

Figure 5 shows the neutron density from the Texas American well. Notice the number of low-

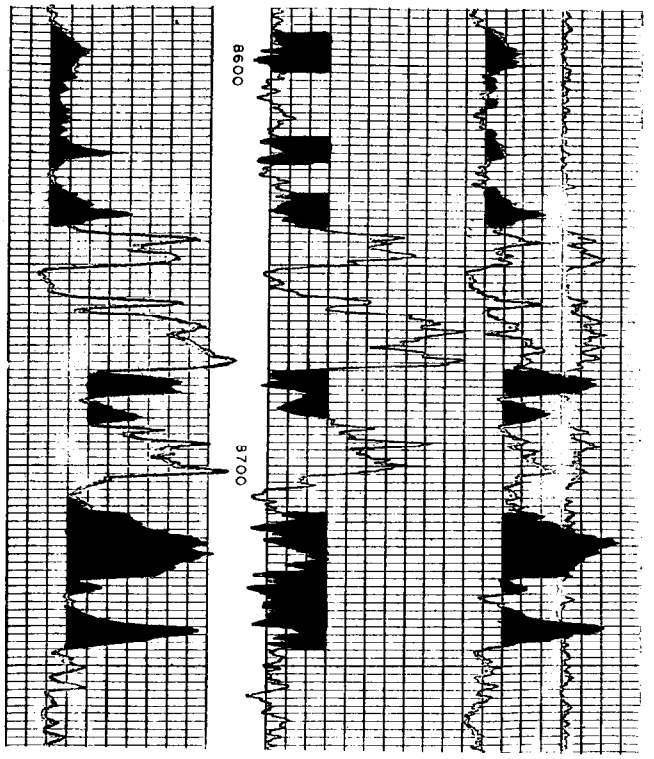

FIGURE 3

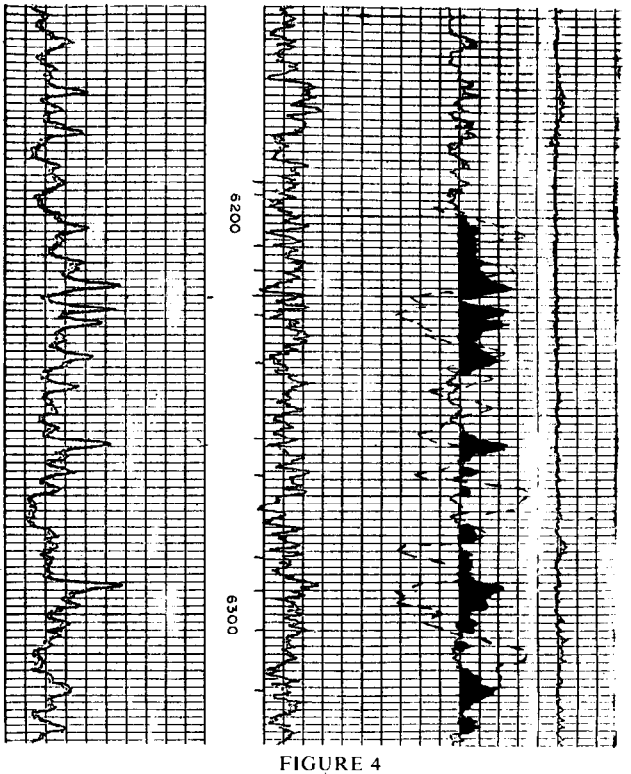

FIGURE 4

porosity zones.

Figure 6 shows a well in the Grayburg formation in Andrews County, Texas. These formations were

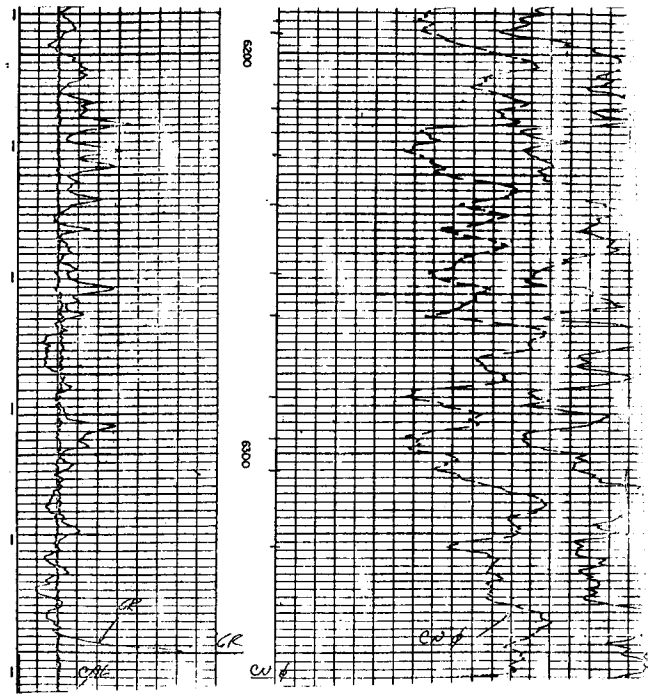

FIGURE 5

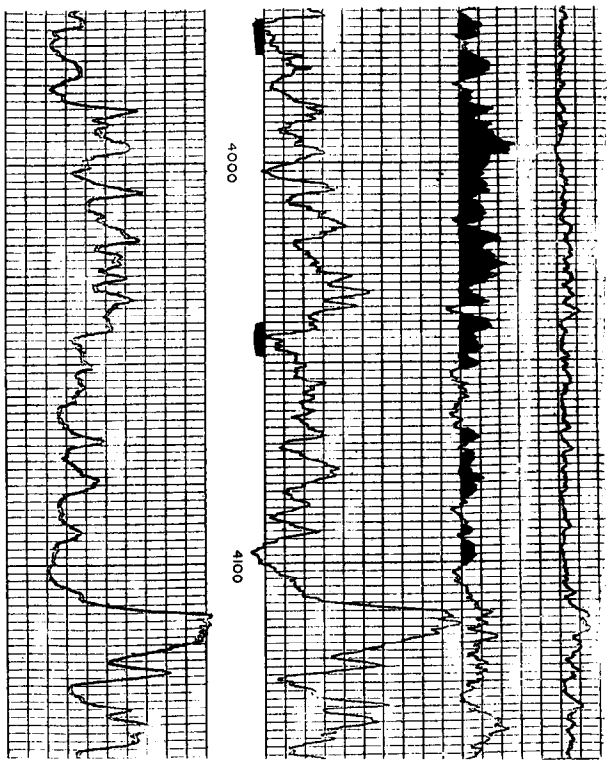

FIGURE 6

picked from the low potassium counts only. This well is producing 12 barrels of oil and 380 mcf. This is a plug-back from a non-productive San Andres well.

Figure 7 shows a Strawn recompletion in Eddy Co., New Mexico. The neutron density shows 3.5 percent porosity. This well was perforated from 9574 to 9595 ft with 2 shots per foot and treated with acid and made 400,000 mcf gas plus 23 barrels of oil. It has an anticipated workover payout of 5 months.

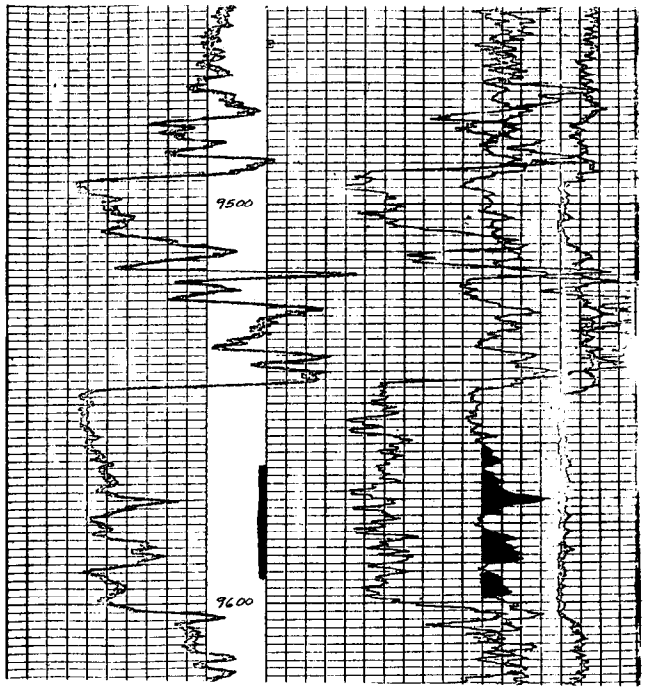

FIGURE 7

Figure 8 shows the same well as Figure 7. There was a gas show from the mud logger when the well was drilled.

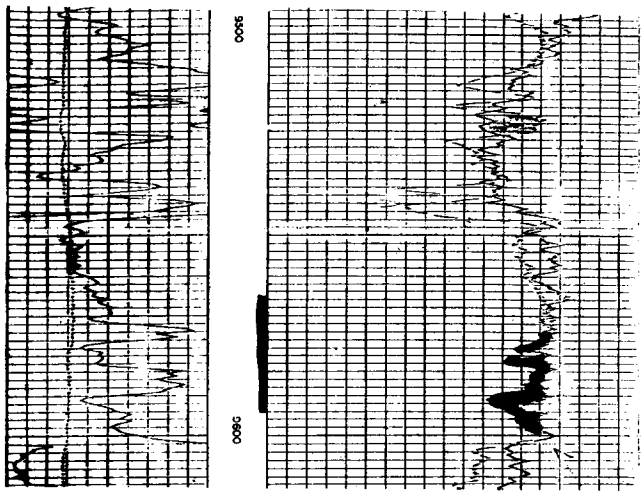

FIGURE 8

Figure 9 shows a workover in Howard County, Texas. This well is in the Atoka formation. There is no porosity log on this well, and it was perforated strickly off the Spectralog from 9300 to 9318 ft. After treatment with 5000 gallons acid, it flowed at a rate of 2.5 mcf on 1/4-in. choke. Next morning, it had 3000 pounds pressure on tubing. After it was opened to a 3/4-in. choke, it flowed at a rate of 40 million.

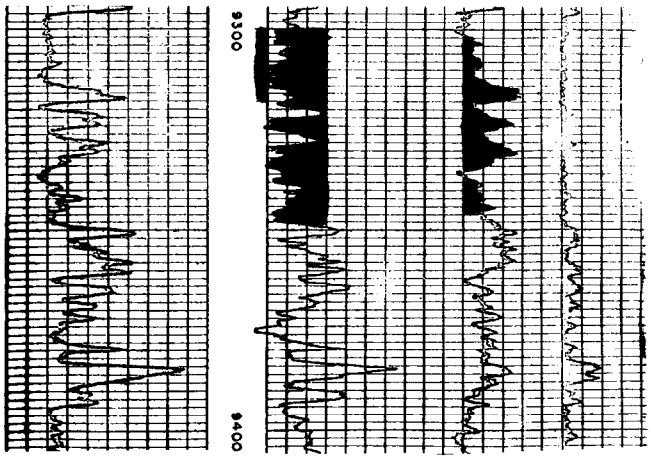

FIGURE 9

Figure 10 shows a well in the Abo formation in Eddy County, New Mexico. The well was perforated from 6234 to 44 ft, and it is making 150 barrels of oil per day.

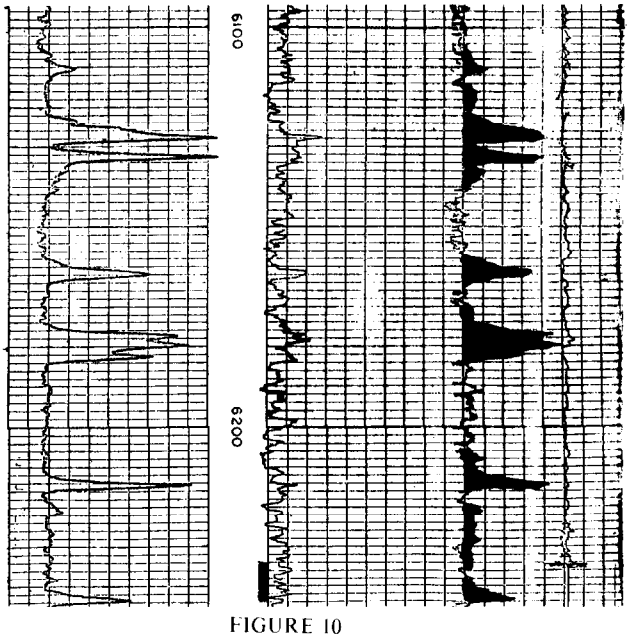

FIGURE 10

Figure 11 shows a well in the Devonian formation in Lea County, New Mexico. This well is perforated from the Spectralog and is making 170 barrels of oil per day.

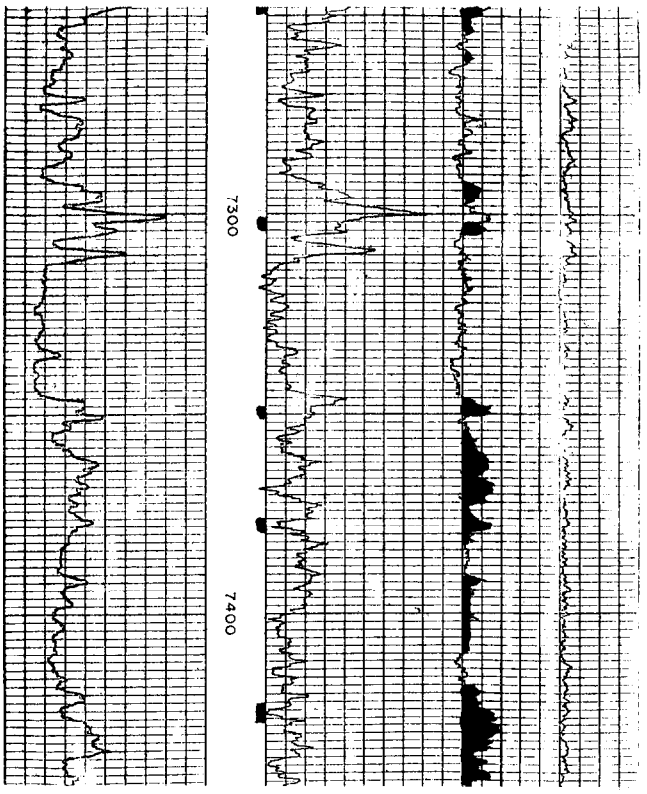

FIGURE 11

Figure 12 shows a well in the Seven Rivers formation of Eddy County, New Mexico. In this field, the normal production is 20 barrels per day, but with the Spectralog, it has been averaging 35 barrels per day.

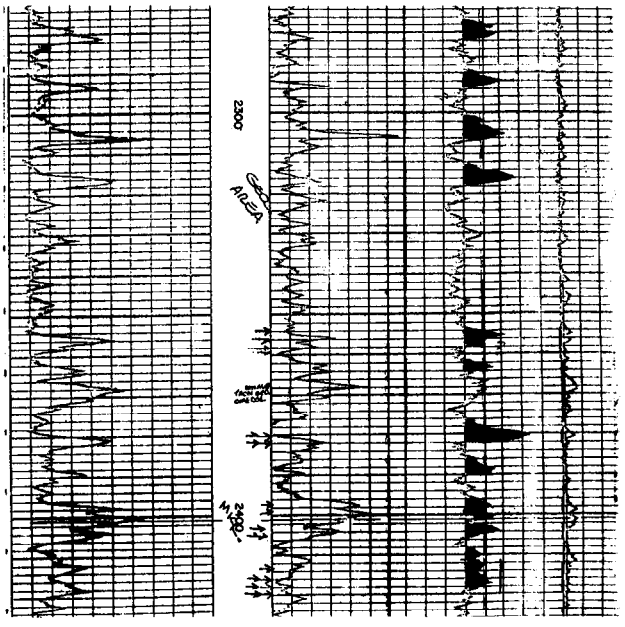

FIGURE 12

Figure 13 shows the same well that Figure 12 shows. The interval from 2204 to 2220 ft is to be perforated. The core analysis shows this zone to be oil bearing also.

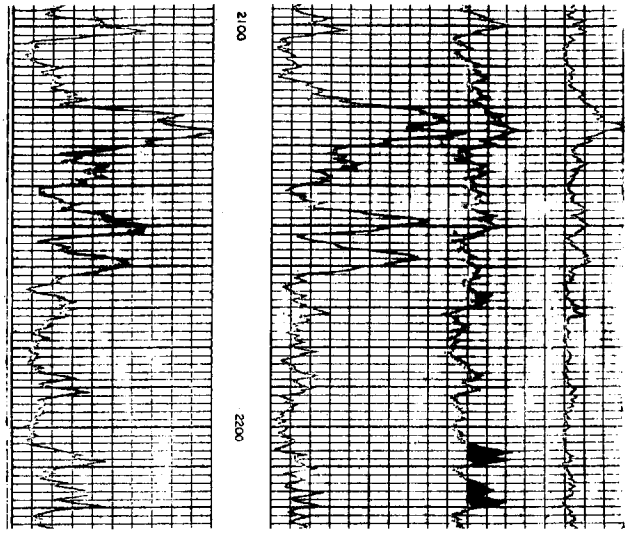

FIGURE 13

Figure 14 shows a well from the Yates formation in Pecos County, Texas.

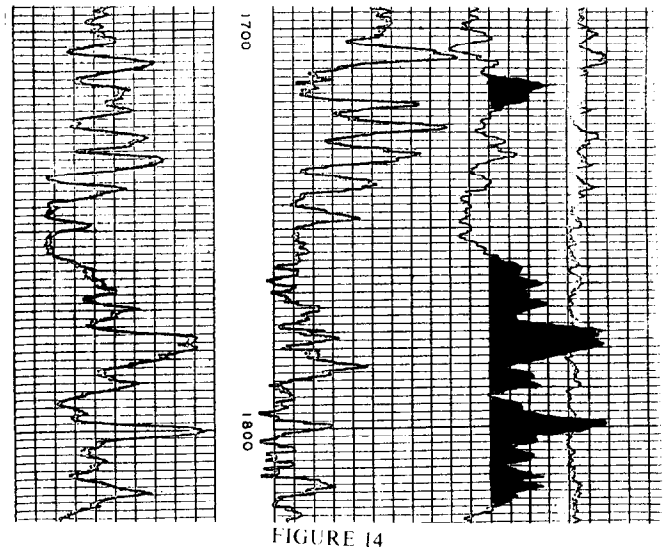

FIGURE 14

Figure 15 shows a well in the Woodford shale in Pecos County, Texas. This zone has low potassium and thorium from 12270 to 12292 ft, and also in the bottom of the formation. This zone is similar to the Eagleford shale in South Texas that produces oil and gas in certain areas.

There are certain areas where we do not have complete knowledge of what the formation is telling us, but we feel that the Spectralog is a tool that can find additional oil in your old and new wells.

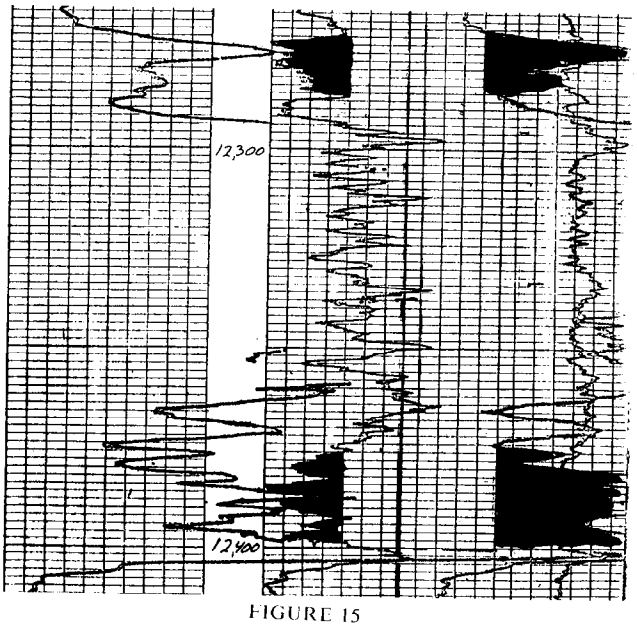

FIGURE 15

REFERENCES

1. Youmans, A. H.: *Spectralog*, Dresser Atlas Division, Dresser Industries, Inc., Houston.
2. Fertl, Walter H., Welker, D. and Hopkinson, E. C.: *The Dresser Atlas Spectralog — A Look at Basic Principles, Field Applications and Interpretive Concepts of Gamma Ray Spectral Logging*, Dresser Atlas Division, Dresser Industries, Inc., Houston.