Remote Sensing Cuts Down Dry Holes

Editor's Note: The following article draws from a paper, "Delineation of a Channel Sand in the Lower Cretaceous Rodessa Formation Using Electrotelluric Surveying Methods," prepared by the author and R.B. Lanter for the 1986 *Southwest Section of AAPG Transactions.*

By Michael R. Birkos

DALLAS-Explorationists can lower their finding costs to $ 3 a barrel by finding high quality wildcat prospects with minimum front end costs. This is done by incorporating sound geologic principles with all available remote sensing technologies, which for the purposes of this article implies all subsurface mapping techniques short of the drill bit.

None of this is new, of course. Operators have always known that if they could improve their wildcat success ratios to 1:3 from 1:8 they could survive virtually any downturn. The purpose of this article is to explain how to achieve 1: 3.

The first step is to define a trend with ample reserve potential in new fields that accommodate today's economics. Once an operator decides on a play, the second step is to analyze the known fields for structural configuration, environment of deposition, reservoir distribution, and most significantly how they respond to one or more remote sensing technology.

For example, field distribution in the Powder River Basin in Wyoming and Montana, the Eastern Shelf of Texas, and the Anadarko Basin of Texas, Oklahoma and Kansas, to name a few, is apparent on Landsat. There is a very good correlation with the location of fields as related to the orientation of surface linaments and drainage features.

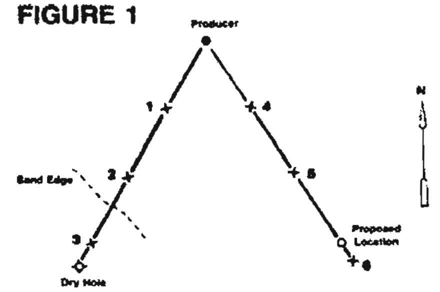
Surface geochemistry and radiometrics have been applied with success in the Trenton Black River trend of southern Michigan, the Mississippian Reef trend, and the Eastern Shelf of North and West Texas. Airborne geochemical reconnaissance has also proven useful in the Eastern Shelf, tracking down Cisco, Canyon, and Strawn reefs, and Tannehill channel sands.

Micromagnetics or aeromagnetic detection of diagenetic magnetite has been successful in central Oklahoma. Biogeochemical prospecting (detection of anomalously high manganese-toiron ratios in plants) has demonstrated value in the Powder River Basin in Wyoming. Gravity surveys worked great defining the salt domes of the Gulf Coast. Seismic has worked to some degree everywhere. Magnetotellurics has provided seismic-like structure data in areas where velocity anomalies inhibit seismic wave propagation.

Improve The Ratio

For all their merit and application, these techniques provide little indication of specific depths and thicknesses of potential reservoirs. This is precisely why industry's finding ratio as a whole is so low. We have not done anything wrong; the problem is that the margin of error in projecting reservoir distribu

FIGURE 1



Location map with survey stations and well control.

tion is so high. Until recently the only way to ultimately test a prospect was by drilling.

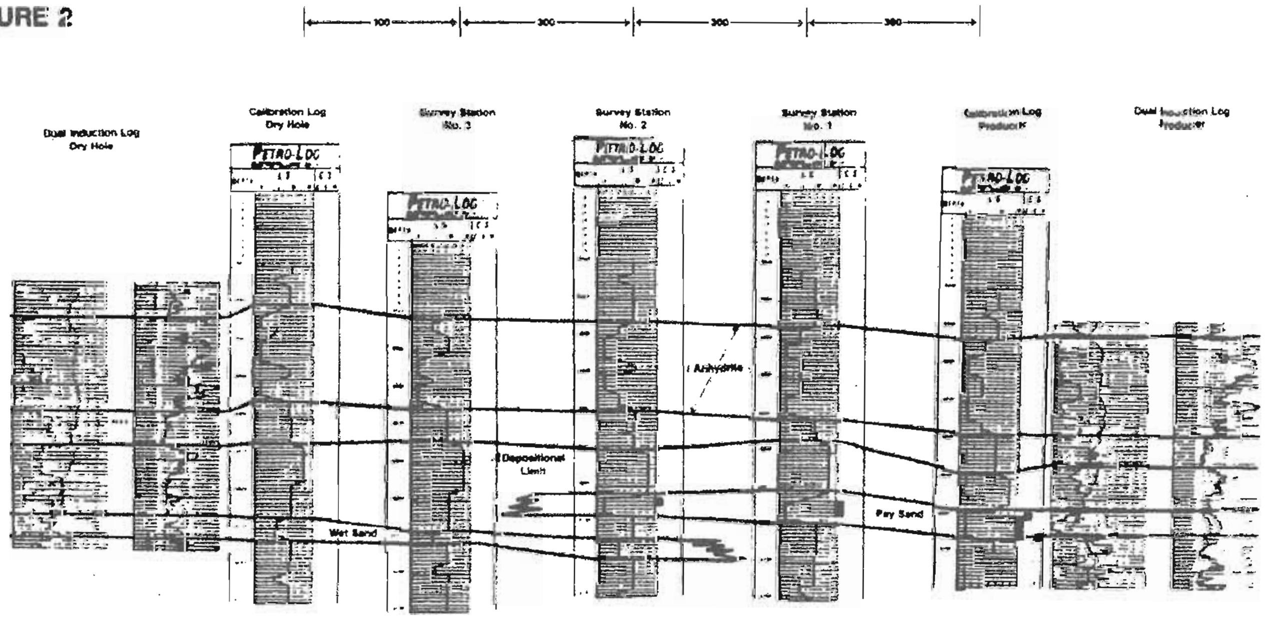
The third step in improving success ratios is to run the most cost effective remote sensing survey along trends that best define the explorer's objectives.

Again, that's not new; everyone knows that. So how do we get from 1:8 to 1: 3? We can now take prospect evaluation a fourth step by defining potential reservoir distribution-specific depth, thickness, and fluid indications-prior to drilling.

A breakthrough in the utilization of electrotelluric radiation allows potential reservoirs to be mapped from the surface in point-specific surveys that have an accuracy comparable to actual drilling data. The electrotelluric data is presented in a format similar to conventional downhole logs, and may be used in the same manner to generate structure/isopach maps, cross sections, etc.

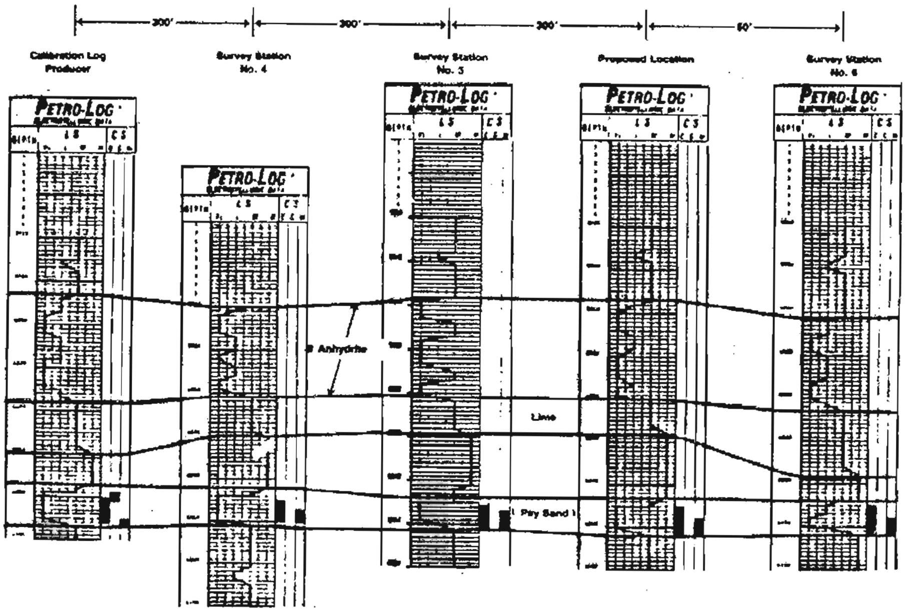
An example of this technique can be seen in the development phase of a channel sand project in East Texas. Fig

FIGURE 2



Cross section between the producing well and the dry hole. Note depositional limit of the pay sand.

FIGURE 3



Cross section between the producing well and the dry hole. Note depositionallimit of the pay sand.

ure 1 is a well control/survey station location map. The operator discovered a Rodessa sand with economic production in the north well. His first choice to offset was the southwest location, but the well showed the sand was not present in that direction.

After the dry hole, an electrotelluric survey was run to provide insight into reservoir distribution across the southeast offset. Cross sections are presented in Figures 2 and 3.

Figure 2 shows the depositional limit of the pay sand between the producing well and the dry hole. Figure 3 shows the continuity of the pay sand between the producing well and the southeast offset.

, Figure 4 compares actual drilling data to the electrotelluric log generated at the drill site. The actual pay sand thickness was five feet while the indicated pay sand thickness was eight feet. The projected depth was within 15 feet of actual, which at 5,200 feet beneath the surface was considered quite acceptable, especially since the primary objective of this survey was determining sand presence.

Avoid Dry Holes

The advantages of this technique are apparent. Obvious dry holes, such as the southwest offset, can be avoided. Had the electrotelluric survey been run first, payout on the second well would have been cut in half.

The same procedure can be applied to wildcat prospects. The optimUm drill sites-maximum potential pay thickness and the most structurally advantageous position-can be located. Or, equally significantly, prospects with non-commercial or no potential pay accumulations can be avoided.

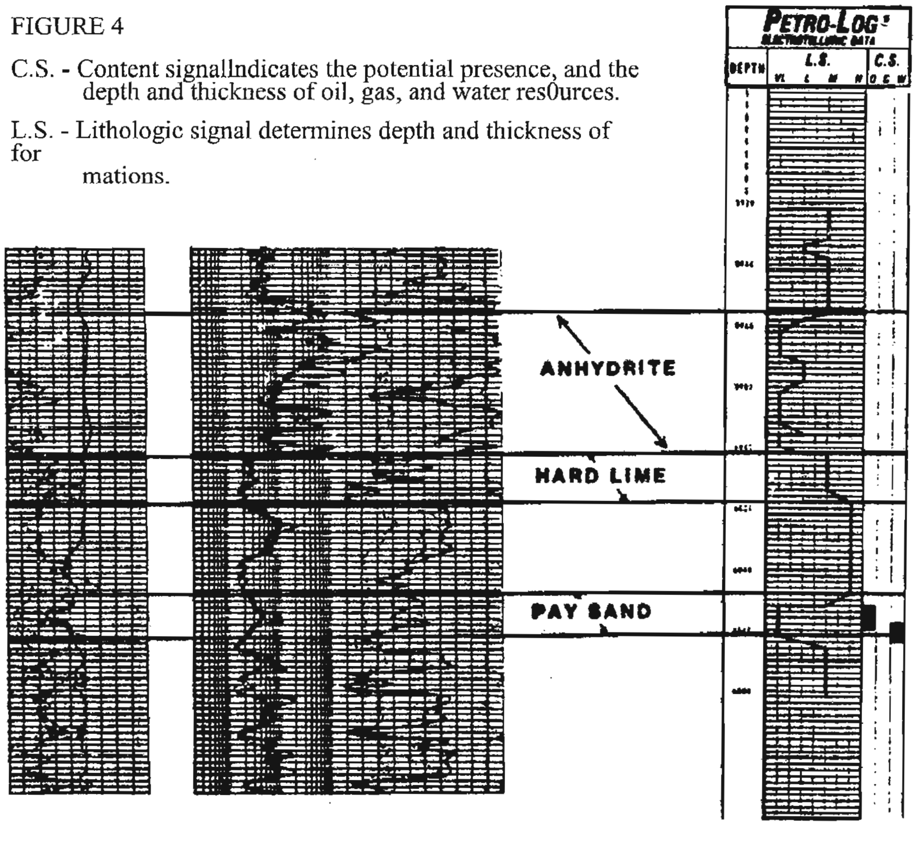
The electrotelluric technique is 95 percent successful in defining locations with no potential, as is every other remote sensing technique. However, the correlation with drill data to electrotelluric data is 33 percent successful on wildcat projects and 70-75 percent successful on development projects.

This obviously can be translated into fewer dry holes. If we all were to drill 50 percent fewer of those this year and found a new field or two, we'd get through this crisis.

FIGURE 4

C.S. - Content signalIndicates the potential presence, and the depth and thickness of oil, gas, and water resOurces.

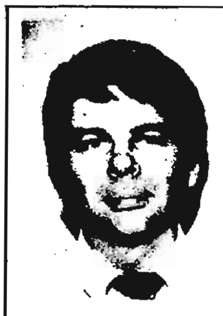
L.S. - Lithologic signal determines depth and thickness of for mations.



ACTUAL LOG
DRILLED 7/7/85

PROPOSED LOCATION
SURVEYED 5/11/85

Comparison of dual Induction log and Petro-Log graph of proposed location.



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