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INTRODUCTION OF FREDERIC F. MELLEN

on the occasion of the celebration of the 50th Anniversary of the discovery of Tinsley Field and the 50th Anniversary of the Mississippi Geological Society

by
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Mississippi Bureau of Geology

NOTE: Frederic Francis Mellen died November 6, 1989. He had a long and distinguished career and is sorely missed. As a memorial, it is fitting that the agency he cared deeply about publish this speech. Bill Moore introduced Fred Mellen at the Tinsley Celebration held in Jackson on August 22, 1989. - *Michael B. E. Bograd.*

I know that when you saw my name on the program, you thought, Bill Moore will get up and say something funny. Well, let's get that out of the way. Fifteen years ago, I wrote a bulletin called - by strange happenstance - TINSLEY FIELD - a commemorative bulletin dedicated to Fred Mellen. I don't know if I was fifteen years ahead of my time or just out of step with everyone else. Well, you finally caught up with me and we're all on the same page.

Enough funny - the rest will be serious, but happy.

Tonight is our time to celebrate. Those in the sponsoring societies and other friends are celebrating because we are proud.

The geologists, geophysicists, landmen, promoters, brokers, secretaries, office managers and technical assistants did something together, and did good, and we are proud.

Along with others like us all over the country, we changed the world and made it better. If you walk outside this building, you will see the lights shining, hear the wheels turning, people moving. We did it, and we are proud.

We have never had help from government or the media, and have asked for little. We have done it ourselves, and if we are needed again, we'll do it again, and we are proud.

When you have stood on a derrick floor at 2:00 a.m. and unscrewed the bit from a core barrel and seen that core slide out, you have felt the hair stand up on the back of your neck, because you know you are where no one else can be. They wouldn't understand, but you do, and you are special, and you are proud.

Sometimes what we have done has had great financial rewards, and sometimes we are left with little. I have watched as a log showed the well was dry and thousands or hundreds of thousands of dollars are gone; and I have watched us walk away grinning, waiting for the next time and knowing that we had a good rip; that for our moment we stood up and laughed at the gods. But that's enough of we - we need to get down to he.

Some of you are probably wondering why I am up here to introduce Fred. Why not one of his contemporaries? There are connecting points.

We are native sons who love Mississippi dearly. We are field geologists, a wonderful but vanishing breed, who many times walk alone. We were State Geologists, who fought the political battles, and won some of them. So, separately or together, we have walked paths peculiarly our own. That's why I am here.

A little more than fifty years ago, a man doing his job, and doing it right, set in motion the events that led to this night.

When you do field geology, and do it right, you don't just ride the roads. You walk every creek, every ridge, see every outcrop, because that's the way it should be done.

Many times nothing comes from surface mapping. This time it did.

I think that two passages from the Tinsley Bulletin are even more appropriate now than when written, and will conclude my introduction.

"Tinsley Field was discovered as a result of the application of the basic principles of geology in a project not specifically directed to oil and gas exploration. The follow-up development of the field utilized much of today's sophisticated petroleum technology. Most of the giant fields in this Country may have been found, and the set of circumstances which led to the Tinsley discovery may not present themselves again. While the possibility may be small, that is what makes the oil industry exciting; the one faint hope that even now another young geologist may be approaching that anomalous outcrop whose discovery may lead to another Tinsley.

"This commemorative bulletin is dedicated to Frederic Francis Mellen. Mr. Mellen was born at Mississippi State University, then Mississippi A&M, on August 21, 1911. He was educated in the Public schools of Starkville, Mississippi, holds a BS Degree from Mississippi State University and a Master's Degree from the University of Mississippi. Mr. Mellen served on the staff of the Mississippi Geological Survey as a geologist and Assistant State Geologist. From the period of 1962-1965, he served as the State Geologist of Mississippi. His work career encompassed work with the Tennessee Valley Authority, British American Petroleum and many years as a consulting geologist. He is presently a consulting geologist in Jackson, Mississippi. Although Mr. Mellen is best known for his discovery which led to the establishment of the Tinsley Oil Field, his geological work also led to the establishment of the Mississippi Valley Portland Cement Company in Warren County, the development of an agricultural lime plant at Cedar Bluff in Clay County, and the Miss-Lite Lightweight Aggregate Plant at Cynthia in Hinds County. He also was a leader in the exploration of the Warrior Basin area in northeastern Mississippi. Although Mr. Mellen has received many honors and much recognition of his geological work, we think that on the 35th anniversary of the Tinsley discovery other recognition should be made. Almost daily we see persons of mediocre talents held up as leaders and their accomplishments extolled far beyond their worth. In the day of the ordinary man it seems fitting to pay tribute to an extraordinary man."

Now I want to introduce him as I think he wants to be introduced. Please hold your applause till you hear all the words. Ladies and Gentlemen, I give you - A Geologist - Frederic Francis Mellen.

EXPLORATION ON MISSISSIPPI'S SALT DOMES

Jack S. Moody
Mississippi Bureau of Geology

Has its time finally arrived? The question refers to an oil and gas exploration effort (play) on the immediate flanks of Mississippi's 51 known shallow salt domes (Figure 1). The shallow salt domes to be considered in this article have cap rock less than 6,000 feet below the surface. The state has some domes of intermediate depth (7,000 to 10,000 feet) and a number of deep domes where salt might be 10,000 feet or deeper. The intermediate and deep salt domes have been actively explored since the 1940's and are responsible for a significant amount of Mississippi's production. For reasons to be considered, the post World War II oil and gas industry has shown little interest in the shallow domes until recently. Let's consider the history of this play in order to understand why its time may have arrived.

In 1901 there was a significant salt dome related oil discovery in Jefferson County, Texas. The field was named Spindletop. Spindletop showed that there was a relationship between the presence of a salt dome and accumulations of commercial quantities of oil and gas. From 1901 to 1925 the field produced over 48 million barrels of oil exclusively from the cap rock. What is even more amazing is the fact that all of that production was under about 250 surface acres. In 1925 production was established on the flanks of Spindletop. This flank production has yielded over 80 million barrels of oil from approximately 250 surface acres. Despite the eventual success in finding significant salt dome production, "The history of exploration on many highly productive domes of the Gulf region shows that early efforts were often unrewarding" (Halbouty, p. 112).

The search for oil around salt domes spread throughout the gulf coast. This effort finally reached Mississippi's interior salt basin in 1937 when Sun Oil found the Midway Dome in Lamar County. Sun drilled a series of wells on Midway; some wells on the flanks encountered thick Cretaceous sands (100-150 feet thick) with heavy asphaltic show throughout. It's not hard to believe that there once was a very nice oil field there. Unfortunately, it seems that Sun was a few million years late at the scene. This same situation of thick Cretaceous sands with heavy asphaltic shows also occurred on other Mississippi dome flanks. The early oil and gas exploration efforts did find small amounts of production on Kings, Bruinsburg, Oakley and McBride domes. In all cases the production was found in Tertiary beds overlying the dome. Drilling also showed that the tops of the domes could be complexly faulted.

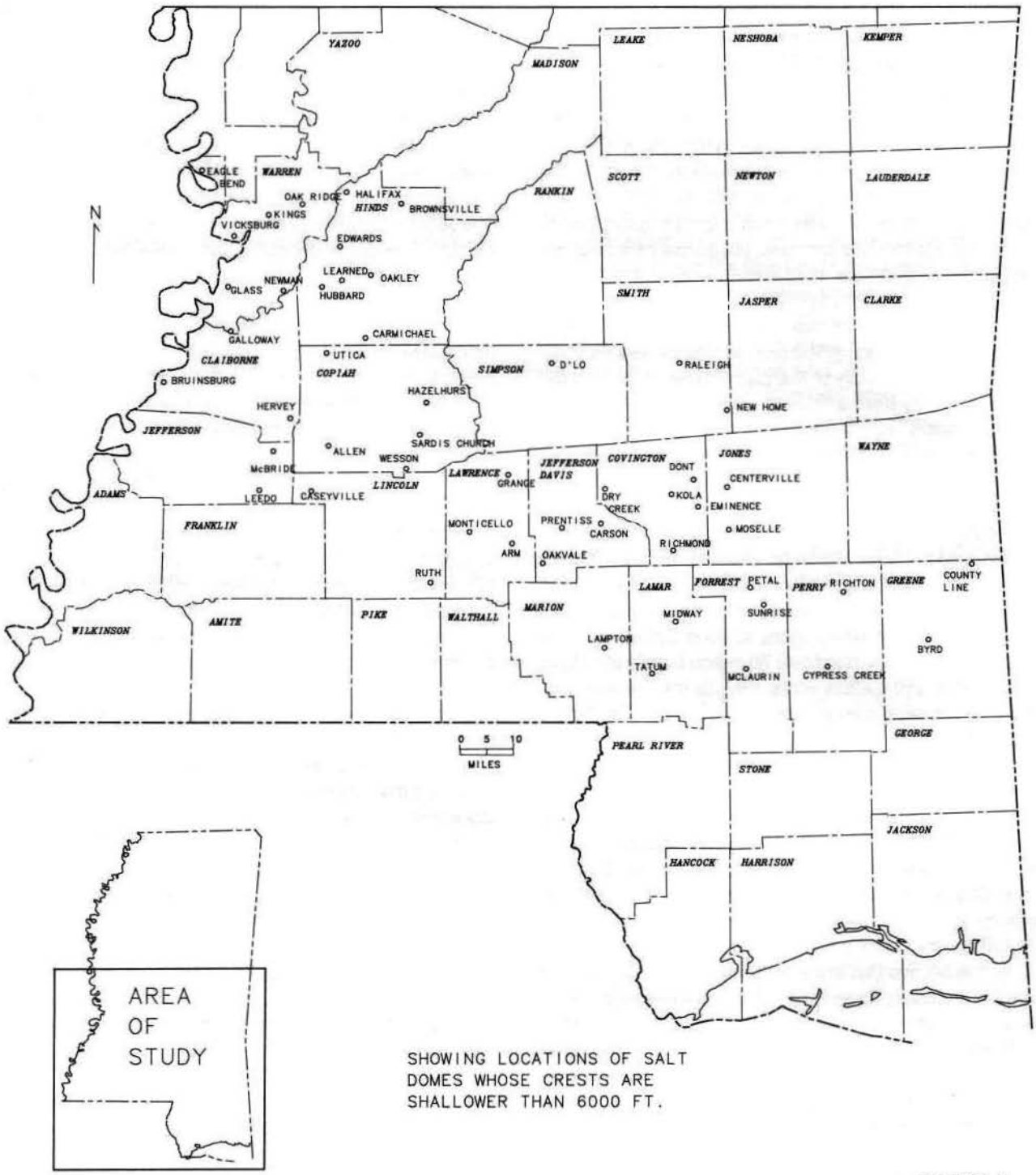
The oil and gas industry was not alone in its exploration of salt domes during the late 1930's and 1940's. Sulfur companies were interested in finding elemental sulfur deposits, which can occur in the cap rock of these domes. In general, the cap rock consists of limestone overlying anhydrite which overlies the salt. Sulfur, when present, will occur between the limestone and anhydrite. The sulfur exploration effort resulted in approximately 110 shallow wells being drilled on 17 domes. The sulfur effort ended without the establishment of any production. The exit of the sulfur companies left the field wide open for the oil and gas interests. Unfortunately, oil and gas had not done much better with respect to commercial reserves. One must remember that throughout this time period there were a number of successful oil and gas plays competing for the exploration capital. The early shallow dome drilling play of the 1930's and 1940's found many domes and revealed the complexity of faulting both on top and on the sides of these domes. It also revealed the presence of minor production and terrific asphaltic shows in the Upper and Lower Cretaceous sands.

Yet the object of this exercise was to find commercial quantities of oil or gas and that did not happen. It is undesirable to continue with a play which is not working. When this is the case the oil industry follows the philosophy, "go away and come again some other day." From an exploration standpoint things remained fairly quiet around these domes throughout the 1950's and 1960's.

There was, however, an interesting non-exploration development with regard to salt domes. World War II created a list of national necessities for the war effort. These necessities mothered many inventions, one of which had to do with the storage of liquid fuels. The idea was to create caverns in the salt by dissolution using fresh water. Once the storage caverns were a desired size the water was removed and liquified petroleum gas (LP, propane, butane) was stored. Mississippi has one such storage facility in the Petal Dome in Forrest County. This same idea of storage was expanded upon in 1970 when Transcontinental Gas Pipe Line Corp. constructed the first solution-mined salt cavern in the U.S. which was specifically designed for natural gas storage. This U.S. first was in the Eminence Salt Dome of Covington County, Mississippi. During the 1980's a great deal of effort was put forth by the Federal government to evaluate the potential and feasibility of using salt domes for permanent disposal of nuclear waste. The good idea from World War II is still a good idea today and will be in years to come. There definitely is an economic potential associated with the storage capabilities in Mississippi's numerous shallow salt domes.

There were some explorationists in the early 1970's that still

SHALLOW SALT DOMES OF MISSISSIPPI



SHOWING LOCATIONS OF SALT DOMES WHOSE CRESTS ARE SHALLOWER THAN 6000 FT.

FIGURE 1.

felt these domes had oil and gas potential. In 1972 Shell Oil drilled a well to test the west flank of Cypress Creek Dome in Perry County. As it turned out Shell had to drill through a salt overhang before they could evaluate the prospective sands. They established production in the Clayton and Paluxy formations. Development of Camp Shelby Field resulted in three producing wells. As of January 1989, the Paluxy had produced 260,141 barrels of oil (B.O.) and 170,427 thousand cubic feet of gas (MCFG). In 1988 the Paluxy yielded 24,072 B.O. from two wells. The Clayton cumulative production through 1988 is 270,195 B.O. and 106,569 MCFG. In 1988 the Clayton produced 12,481 B.O., 43,647 barrels water, and 1,891 MCFG from one well. If the water cut (amount of water produced along with the oil) continues to climb, this well will become unprofitable to produce in the next several years.

Let us digress at this point in order to briefly evaluate the economics of oil and gas production, using Camp Shelby Field for the example. In developing the field Shell drilled three producers and two dry holes, one of which became a salt water disposal well. We are going to assume an average cost of $1 million per well or $5 million for drilling and completing the field. We now will assume an average royalty of 19%, and severance tax of 7%. These two items come right off the top; for every 100 barrels produced, the mineral owner gets 19 barrels and the state gets 7 barrels. In addition to these items, the cost of operating the producing wells must be considered; we will assume 10%. Now let's make a rough evaluation of this field's economics as of January 1989. We'll use an average price of $16/barrel and $1.50/MCFG. The field has produced 530,336 B.O. (not bad) and 276,996 MCFG (not good).

530,336 B.O.	276,996 MCFG
x $16/barrel oil	x $1.50/MCFG
$8,485,376 gross	$415,494 gross

Total gross income
$8,900,870
x .64 less royalty, severance and operations (36%)
5,696,556
- 5,000,000 drilling cost
$ 696,556 apparent profit

We did not take into account Shell's land, seismic and exploration overhead. While Shell has taken all of the financial risk, say $5 million investment, it may not make any profit - but the mineral owners and the state have made $2,314,226 profit from royalty and severance tax. The point of this lesson is to illustrate the economic realities of oil and gas exploration. One must bear in mind the bottom line of all this exploration effort is not to find oil and gas, it is for the exploration company to make money. Camp Shelby's significance is not in its economics, as seen above, but it is with regard to its producing from the steeply dipping formations that are against the salt dome. Some would say it was a scientific success but an economic failure. It is a failure only in the sense that it may not make a lot of money for the company.

From 1973 to 1981 the oil industry experienced steady to dramatic increases in oil and gas prices which resulted in the most active exploration effort in U.S. history. This effort was fueled by the perception that prices could only increase with time. Budgets and commitments (often highly leveraged commitments) were directed by this thinking. Then in 1982 the unthinkable happened; despite the best laid plans of mice and men, prices made a slight decline. This was the beginning of what turned out to be the worst recession the oil industry has ever known. The national rig count went from over 4,000 working rigs to less than 700. Figure 2 shows the trend of oil and gas prices in Mississippi from 1970 to 1987 and the precipitous drop in rig activity from 1981 to 1986.

Yet in this worst of times there was still some drilling going on. In 1985 Enserch drilled a 17,400-foot wildcat on the southwest flank of Oakley Dome in Hinds County. Although the primary deep target was not productive, the well had encountered shows of oil in the Rodessa Formation at a depth of 11,743 feet. Enserch completed the well, which was not a particularly good well, but by the time Enserch had developed the field it had 13 producers from four different zones.

The Oakley Dome actually has three fields on its flanks. The largest is West Raymond Field, which is on the southwest flank. There are two Rodessa wells in the Oakley Dome Field and two Rodessa wells in the North Oakley Dome Field. Neither of these fields appear to be commercial (profitable). When all is said and done, Enserch will be fortunate to make money from its Oakley Dome (all three fields) investments. Like Shell, they found a field; they just needed to find a better one.

Yet this exploration success is very important to those few left in the exploration industry by 1986. Camp Shelby and West Raymond fields showed that reservoirs were trapping against the sides of these salt domes. In 1986 Sun drilled the #1 W.W. Speed well, discovery well for Leaf River Field. The field is located on the south flank of Dont Dome in Covington County. The well was a dual completion from the Rodessa and Sligo formations. This first well tested 3,300 thousand cubic feet of gas per day (MCFGPD) and 158 barrels of oil from the Rodessa and 310 barrels of oil and 410 MCFGPD from the Sligo. Oryx (was Sun) has successfully offset the discovery well with their #1 S.P. Speed. This well flowed 154 barrels of oil and 1,350 MCFGPD through an 8/64 inch choke (that's small) with good pressure. Sometimes a company would like to develop an oil discovery without attracting unwanted competition. Testing a good well through a small choke is a good way to do this. Their reasoning was that "people just don't get as excited about 158 barrels of oil as they do about 800 or 900 barrels." There was also a very interesting Paluxy sand in the #1 S.P. Speed. Oryx has since permitted a well to test

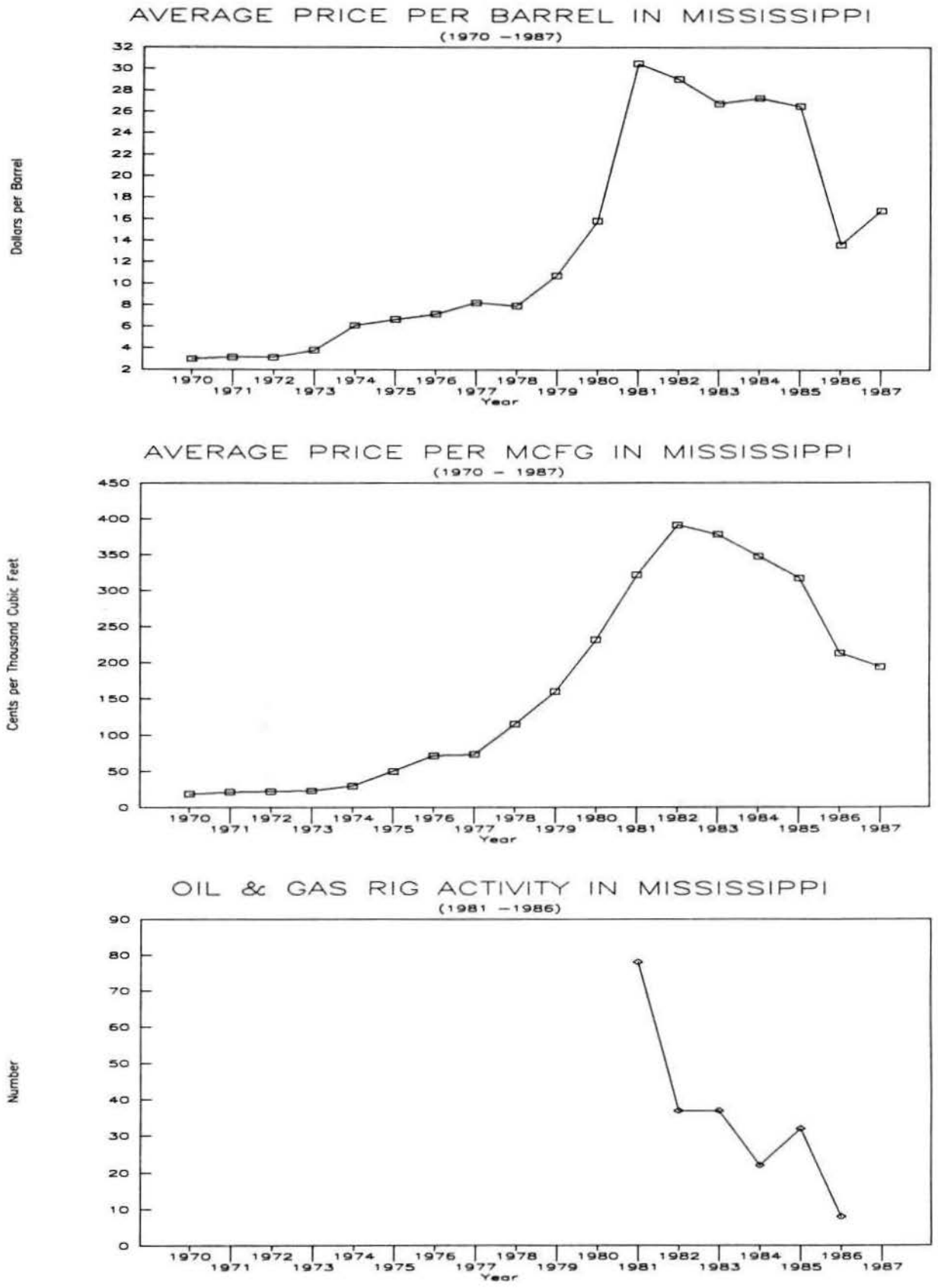

AVERAGE PRICE PER BARREL IN MISSISSIPPI
(1970 –1987)
Dollars per Barrel
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987
Year
AVERAGE PRICE PER MCFG IN MISSISSIPPI
(1970 – 1987)
Cents per Thousand Cubic Feet
450
400
350
300
250
200
150
100
50
0
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987
Year
OIL & GAS RIG ACTIVITY IN MISSISSIPPI
(1981 –1986)
Number
90
80
70
60
50
40
30
20
10
0
1970 1971 1972 1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987
Year

Figure 2.

the Paluxy.

Following its success at Dont Dome, Oryx drilled a rank wildcat in 1989 on the flanks of Centerville Dome in Jones County. The Oryx #1 Frankie Smith was completed from multiple Hosston sands at depths from 15,906 to 16,200 feet. The well was tested flowing 4,400 MCFGPD and 1,224 barrels of oil through a 32/64 inch choke. Testing a good well through a big choke is a good PR move if you want to enjoy a little headlines recognition.

Although it is too early to predict how these Oryx fields will turn out (remember the object is to make money), one can't help but get excited about the potential for significant (big money-making) fields being out there somewhere. The industry seems to have accepted the fact that there are not going to be a lot of big fields (30+ wells) left for the finding; there are some, but not many. Having accepted this maxim, they are pursuing smaller prospects which offer good reserves on a per well basis. In other words, these fields may be small, i.e. 1-3 million barrels, but each of the few wells (2-5 wells) will make a lot of oil. A good example of this new acceptable prospect size is the updip Smackover of southern Alabama. This play is generally looking at fields of two to four wells, less than 500 acres, perhaps 1-3 million barrels, at 14,000 feet, and the play is generally looking at a single objective. The recent advances in seismic quality have proven to be the backbone of this exploration effort. The Mississippi salt dome play meets these same exploration requirements. The prospects don't cover a large area (600 acres), but multiple, thick objective sands steeply dipping against the salt dome can result in very large per well reserves. Modern seismic techniques allow both a better definition of the salt-sediment interface and the faulting associated with the domes.

There is a lot of room for successful (money-making) exploration around Mississippi's shallow salt domes. Halbouty pointed out that early exploration was discouraging on many Gulf region domes that were subsequently found to be highly productive. Perhaps Mississippi's time has finally arrived.

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