U. S. GEOLOGICAL SURVEY
CONSERVATION DIVISION
Gulf of Mexico OCS Operations

GEOLOGICAL AND OPERATIONAL SUMMARY CONTINENTAL OFFSHORE STRATIGRAPHIC TEST (COST) NO. 2 MUSTANG ISLAND

Offshore South Texas

by

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U. S. GEOLOGICAL SURVEY
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I. GEOLOGICAL INTRODUCTION

A. Location

The Continental Offshore Stratigraphic Test No. 2 (COST NO. 2) was drilled in Block A-29 of the Mustang Island Area, 42 miles offshore south Texas (see Figure No. 1).

B. Reason for Drilling

The COST NO. 2 well was drilled as a deep stratigraphic test to acquire additional knowledge of stratigraphic and lithologic conditions that is essentially lacking in this unexplored area of the south Texas OCS. Thirty-two oil companies participated in this program on a cost-sharing basis. Superior Oil Company served as an operator for the group.

C. Lease History

The drilling of COST NO. 2 well commenced prior to the first south Texas OCS Lease Sale which was held in January 1975. Mustang Island Block A-29 was not offered for leasing in the January sale, nor does it have any previous lease history. The drilling site was purposely located off-structure to minimize the chances of encountering hydrocarbons. The USGS approved the drilling application for the deep test in accordance with applicable Federal regulations.

II. SUMMARY OF WELL DATA

1. Company: The Superior Oil Company
2. Lease Designation: Unleased
3. Well No.: No. 1
4. Location: 1100 FNL & 2650 FWL of Block A-29
5. Classification: Offshore Deep Stratigraphic Test
6. Elevation: K.B. - 90.0' D.F. - 89.0'
7. Water Depth: 240'
8. Contractor: Penrod Drilling Company
9. Spud Date: 12-6-74
10. Date T.D. Reached: 2-10-75
11. Completion Date: 2-19-75
12. Status: P & A
13. Total Depth: 13000'
14. Plug-Back Depth: 450'

III. OPERATIONAL DATA

A. Mud Program

0' -	3929'	Native Gel
3929' -	9356'	Spersene
9356' -	11327'	Lignosulfonate
11327' -	13000'	Spersene - CMC

B. Hole Dimensions

Size	From	To
26"	0'	1093'
17-1/2"	1093'	3929'

Size	From	To
12-1/4"	3929'	9356'
8-1/2"	9356'	13000'

C. Open Hole Formation Tests

Test 1

Depth:	4350'
Sampling Time:	25 minutes
Recovery:	10200 cc water,50cc drl.fl
Flowing Pressure:	2250 psi
Initial Shut-in Pressure:	2250 psi
Final Shut-in Pressure:	2250 psi

Test 2

Depth:	4608'
Sampling Time:	25 minutes
Recovery:	10200 cc water 50 cc drilling fluid 0.1 cu/ft gas
Flowing Pressure:	2150 psi
Initial Shut-in Pressure:	2450 psi
Final Shut-in Pressure:	2450 psi

Test 3

Depth:	4916'
Sampling Time:	25 minutes
Recovery:	10200 cc water 50 cc drilling fluid 0.2 cu/ft gas
Flowing Pressure:	2550 psi
Initial Shut-in Pressure:	2550 psi
Final Shut-in Pressure:	2550 psi

Test 4

Depth:	5376'
Sampling Time:	25 minutes
Recovery:	10200 cc water 50 cc drilling fluid 0.2 cu/ft gas
Flowing Pressure:	2750 psi
Initial Shut-in Pressure:	3000 psi
Final Shut-in Pressure:	3000 psi

Test 5	
Depth:	10766'
Sampling Time:	12 minutes
Recovery:	9650 cc water 600 cc drilling fluid
Flowing Pressure:	7100 - 7200 psi
Initial Shut-in Pressure:	-
Final Shut-in Pressure:	7500 psi

D. Cores

No conventional cores were taken.

Sidewall cores were taken from 1160' - 12960'

Samples Analyzed: 274

E. Surveys

Operator	Type	Scale	Run No.	From - To
Schlumberger	ISF/Sonic	1"	5	1090' - 12978'
	ISF/Sonic	5"	5	1090' - 12978'
	5'-7' Sonic	1"	3	3926' - 12986'
	5'-7' Sonic	5"	3	3926' - 12986'
	7'-9' Sonic	1"	3	3926' - 12986'
	7'-9' Sonic	5"	3	3926' - 12986'
	CNL	5"	5	250' - 12980'
	FDC	5"	5	250' - 12980'
	Dipmeter	1"	3	1090' - 12990'
	Dipmeter	5"	3	1090' - 12990'
	Temperature	1"	1	200' - 12988'
	Temperature	5"	1	200' - 12988'

F. Electric Log Interpretation

In contrast to the COST NO. 1 well (U. S. Geological Survey Open-File Report 75-174, by A. S. Khan and others, May 1975), the electric logs of the COST NO. 2 well show some sands, principally in the upper 5,500 feet of section. All sand bodies are water productive. The lithologic plots (Figures 2 and 3) show the COST NO. 2 well lithologic characteristics. These can be compared to the similar plots contained in the COST NO. 1 well report.

There is no sand at all in the first 1,900 feet. At 1,934 feet the first of a few thin, low-permeability, shaly sands appears. Below 2,460 feet the sand quality improves, and there are numerous sands in the interval down to 3,280 feet. These sands have shale contents of 30 percent and above, and porosities approximating 33 percent. From 3,280 feet to 4,300 feet, sands are infrequent, but have the same characteristics as those above.

At 4,300 feet the first sand with reservoir rock characteristics is indicated. Sands of this nature are numerous within the next 1,100 feet of section, down to a depth of 5,380 feet. These sands have 30 to 33 percent porosities, and have shale contents of 20 percent or less.

The interval from 5,380 to 10,234 feet is essentially 100 percent shale. The only exceptions are three probable lime streaks from 7,810 to 7,825 feet, a possible two-foot

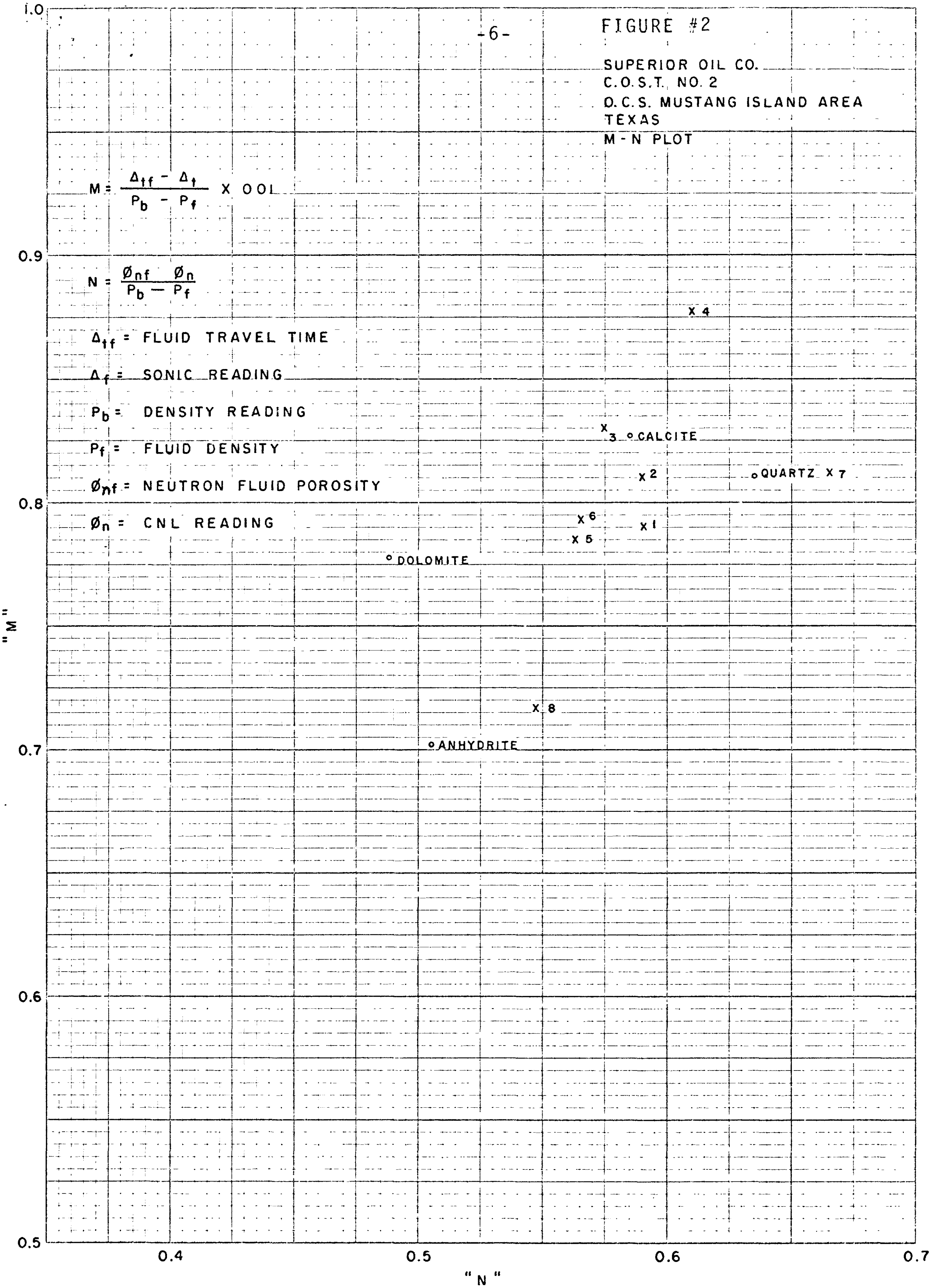

FIGURE #2

SUPERIOR OIL CO.
C.O.S.T. NO. 2
O.C.S. MUSTANG ISLAND AREA
TEXAS
M - N PLOT

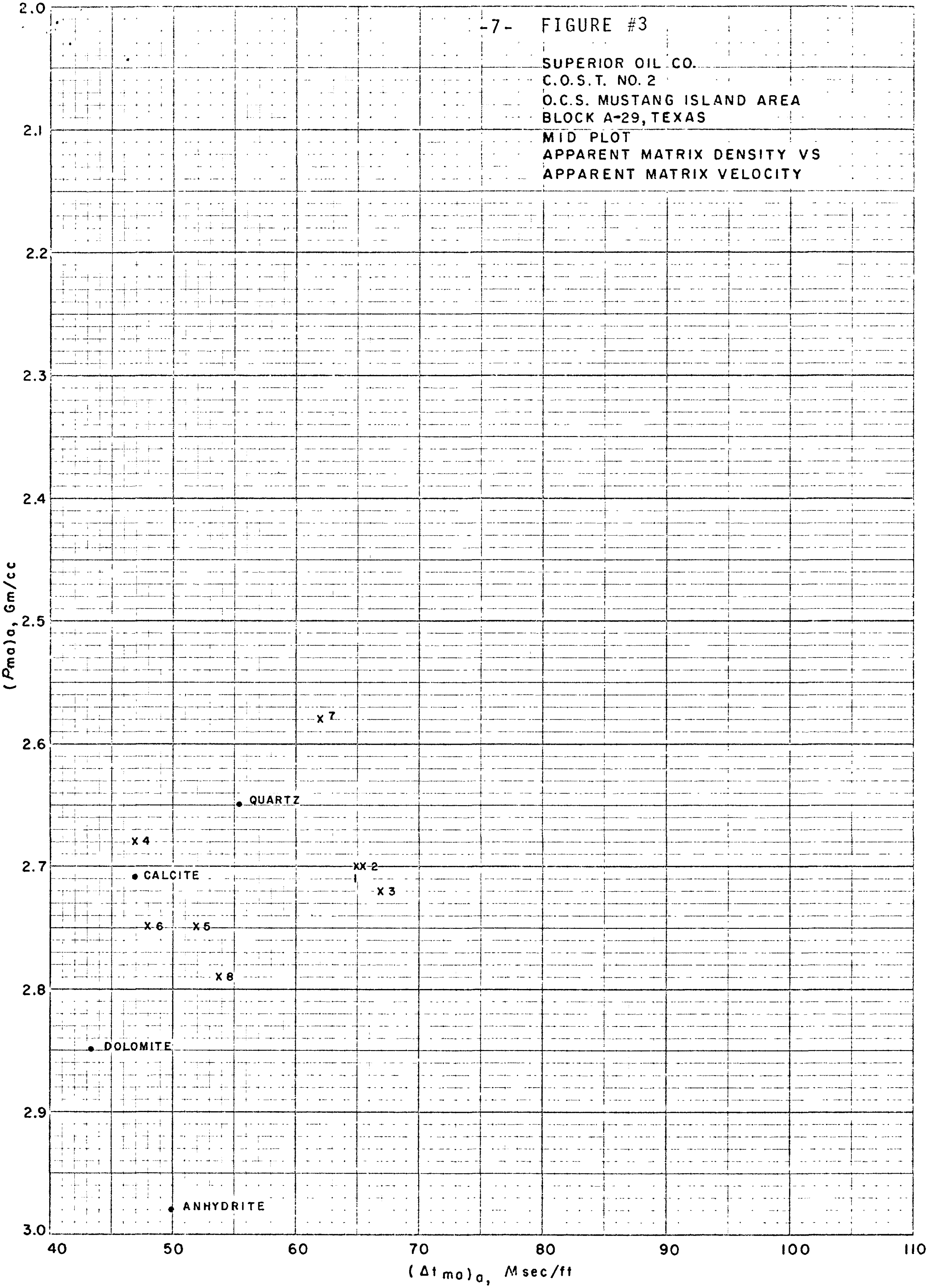
FIGURE #3
SUPERIOR OIL CO.
C.O.S.T. NO. 2
O.C.S. MUSTANG ISLAND AREA
BLOCK A-29, TEXAS
MID PLOT
APPARENT MATRIX DENSITY VS
APPARENT MATRIX VELOCITY
(ρ_{ma})a, Gm/cc
(Δt_{ma})a, Msec/ft
2.0
2.1
2.2
2.3
2.4
2.5
2.6
2.7
2.8
2.9
3.0
40
50
60
70
80
90
100
110
X 7
QUARTZ
X 4
CALCITE
XX-2
1
X 3
X 6
X 5
X 8
DOLOMITE
ANHYDRITE

sand at 7,966 to 8,968 feet, and a tight sand from 9,172 to 9,185 feet.

At 9,000 feet the rocks show higher compaction, and below 10,310 feet compaction is maximum.

The next three sands in the well are at 10,224 to 10,232 feet, 10,642 to 10,650 feet, and at 10,758 to 10,771 feet. These are well-cemented calcareous sands with low porosities.

From 10,772 feet to total depth the section is essentially shale, broken infrequently by tight sandy or limy streaks. At total depth (13,000 feet) the operator was drilling in a very tight sand.

The "M-N" plot and the Matrix Identification (MID) plot are included to show the lithological character of several beds, determined from the sonic, density, and neutron logs. The points chosen are listed in Table I. Pure mineral points have been plotted for reference. The plots indicate that most of these sands are somewhat carbonaceous. This may be some of the cementing material of the sands. There is a significant improvement in sand quality in the COST NO. 2 well as compared with the COST NO. 1. The shallow sands from 2,450 to 4,300 feet were not plotted, since they have not been compacted sufficiently to have reliable sonic and neutron log readings. If plotted they would display a high shale content.

TABLE I

LOG INTERPRETATION DATA

LOG DATA AND CALCULATIONS

POINT	DEPTH	ρ_b	Ød	Δ_t	Δ_t (corr)	Øs	Øcnl
1	4340-4346	2.10	.33	114	102	.435	.39
2	4600-4614	2.15	.30	110	96	.405	.36
3	4910-4918	2.20	.27	110	89	.405	.35
4	5372-5378	2.13	.32	90	90	.28	.35
5	9179-9183	2.40	.15	83	79	.206	.24
6	10224-28	2.45	.12	74	74	.14	.22
7	10764-68	2.28	.22	85	85	.215	.18
8	12918-60	2.50	.09	80	80	.18	.21

LOG INTERPRETATION DATA

PLOT POINTS

POINT	DEPTH	M-N Plot M	M-N Plot N	Mid Plot Δ_{tma}	Mid Plot ρ_{ma}
1	4340-4346	.79	.59	65	2.7
2	4600-4614	.81	.59	65	2.7
3	4910-4918	.83	.575	67	2.72
4	5372-5378	.876	.61	47	2.68
5	9179-9183	.785	.564	52	2.75
6	10224-28	.793	.565	48	2.75
7	10764-68	.812	.665	62	2.58
8	12918-60	.726	.547	54	2.79

NOTE: ρ_b = density log reading
ϕd = porosity from density log
Δ_t = sonic log reading

Δ_t corr = sonic log travel time corrected for compaction
ϕs = porosity from corrected travel time
ϕcnl = porosity reading from cnl
M-N = calculated parameters
Δtma = apparent rock matrix travel time, calculated
ρ_{ma} = apparent rock matrix density, calculated

G. Rock Characteristics

The following sample descriptions, permeability, and porosity measurements (TABLE II) on selected sidewall core samples were determined by Core Laboratories, Inc.

H. Pipe Record

Size	Depth Set (MD)	Hole Size	Cementing Recor
30"	602'	Driven	-
20"	1093'	26"	2605 sacks TLW
13-3/8"	3929'	17-1/2"	3459 sacks TLW
9-5/8"	9356'	12-1/4"	1500 sacks Clas "H
Open Hole to	13000'	8-1/2"	

IV. SAMPLE AND CIRCULATION

A. Sample Program

From	To	Sample Interval
780'	13000'	30'

B. Circulations

N.A.

C. Lost Circulation

N.A.

TABLE II

Depth in Feet	Permeability Millidarcys	Porosity Percent	Sample Description
1160	0.02	17.1	Sh,brn-gry
1938	263	21.8	Sd,gry v/fn grn
2156	116	20.6	Sd,gry v/fn-fn grn, s/lamin,shy
2412	119	19.5	Sd,gry,fn-v/fn grn, s/shy-shy c/calc
2461	148	25.3	Sd,gry,fn grn,s/shy, s/calc
2515	20	20.4	Sd,gry,v/fn grn,v/shy, foss
2653	123	29.8	Sd,gry,fn grn,s/shy,calc
2792	204	29.2	Sd,gry,fn grn,cl,s/calc
2821	361	30.6	Sd,gry,fn grn, s/shy, s/calc
2878	158	22.5	Sd,gry,fn grn,s/shy,slty, s/calc
2915	41	29.3	Sd,gry,fn grn,s/shy,foss
2958	40	22.4	Sd,gry,v/fn-fn grn,s/shy-shy,calc
3014	389	29.0	Sd,gry,fn grn,cl
3067	35	21.1	Sd,gry,v/fn-fn grn,s/shy-shy,calc
3115	57	23.8	Sd,gry,fn grn,s/shy,calc
3167	263	18.8	Sd,gry,fn grn,shy,calc
3248	15	16.3	1/2 sd,gry,v/fn grn,lamin calc, 1/2 sh
3278	83	30.8	Sd,gry,fn grn,s/shy,calc
3424	57	21.8	Sd,gry,v/fn grn,v/shy, calc
3571	77	24.2	Sd,gry,fn grn,s/shy-shy, lamin,calc
3575	1040	32.6	Same as above
3640	22	20.3	Sd,gry,v/fn grn shy-v/shy calc
3735	12	21.8	Sd,gry,fn grn, s/shy,s/ calc
3759	90	23.6	Sd,gry,fn grn,s/shy
3781	20	19.1	Sh,gry,slty,sdy,calc,foss
3954	20	22.7	Sd,gry,v/fn-fn grn,shy, calc
4235	22	22.8	Sd,gry,v/fn grn,shy,calc
4310	158	33.4	Sd,gry,fn grn,s/shy,s/ calc
4351	33	29.5	Same as above
4363	251	33.4	Same as above
4574	18	21.8	Sh,gry,v/sdy,v/calc,lamin
4578	52	29.1	Sd,gry,v/fn-fn grn,s/shy, s/calc
4607	-	33.9	Same as above
4610	154	33.7	Same as above

Depth in Feet	Permeability Millidarcys	Porosity Percent	Sample Descriptions
5120	107	31.9	Sd,gry v/fn grn,s/shy, lamin,calc
5180	55	33.2	1/2 sd,gry,v/fn grn, s/shy, 1/2 sh,calc
5337	5.5	19.9	Sd,gry,v/fn grn,lamin, calc
5373	64	29.7	Sd,gry,v/fn-fn grn,s/shy, c/calc
5377	141	31.6	Same as above
5418	4.4	18.5	Sd,gry,v/fn grn,shy,slty, lamin,calc
5482	74	16.1	Sd,gry,v/fn grn,shy-v/shy lamin,calc
5742	7.9	17.7	Sd,gry,v/fn grn,v/shy, lamin,v/calc
5847	4.5	19.6	Sd,gry,v/fn grn,shy,v/calc, frac
6150	138	20.6	Sh,gry,calc,stk sd,v/fn grn,lamin
7348	421	22.3	Sh,gry,calc
7402	382	21.5	Sd,gry,v/fn grn,slty,v/calc
7443	4.7	20.1	Same as above
7968	308	21.3	Sh,tan-gry,calc
8610	25	14.7	Sh,gry,calc
9404	0.05	22.6	Sh,gry,calc
10050	0.03	16.9	Same as above
10766	3.2	24.6	Sd,fn grn, sl/shy,calc
11350	0.07	21.8	Sh,gry,calc
12266	0.03	19.9	Same as above
12920	41	19.3	Sd,gry,v/fn grn,v/shy-shy

V. STRATIGRAPHY

The COST NO. 2 well penetrated a thick, clastic sedimentary sequence, mostly of Tertiary age. The stratigraphic sequence penetrated in this well is very similar to that of the COST NO. 1 in South Padre Island East Addition. Table III shows the stratigraphic section penetrated in the well. The sediments are of Miocene, Pliocene and Pleistocene age. Because of the distance from the nearest well in state waters and the lateral change in lighologic characters, a regional log correlation was not possible. All the geological datums were identified strictly by paleontological examination of the sediments. The paleontological determinations provided highly reliable stratigraphic information. Figure 4 shows the biostratigraphic correlation between COST NO. 2 and COST NO. 1, based on common paleontological datums identified in both wells. This correlation illustrates the thickening of the biostratigraphic zones between COST NO. 2 and NO. 1

THE MIOCENE SECTION

The offshore stratigraphic section is equivalent to the Fleming group of local usage onshore Texas, and for the purpose of this report is divided into a lower Miocene equivalent of the Oakville Formation and an upper Miocene equivalent of the Lagarto Formation. The Miocene section penetrated in the subject well includes sediments of both lower Miocene and upper Miocene age.

TABLE III

STRATIGRAPHIC SECTION PENETRATED BY C. O. S. T. No. 2

PERIOD	EPOCH		BIOSTRATIGRAPHIC ZONES
NEOGENE	PLEISTOCENE		TRIMOSINA "A" ANGULOGERINA "B" LENTICULINA 1
	PLIOCENE		VALVULINERIA "H" BULIMINELLA 1
	MIOCENE	UPPER	BIGENERINA "A" DISCORBIS 12 TEXTULARIA "W" BIGENERINA 4 CIBICIDES 12 A AMPHISTEGINA "B"
		LOWER	ROBULUS 43 CRISTELLARIA 54A – EPONIDES 14 CRISTELLARIA 54B GYROIDINA "K" DISCORBIS "B"

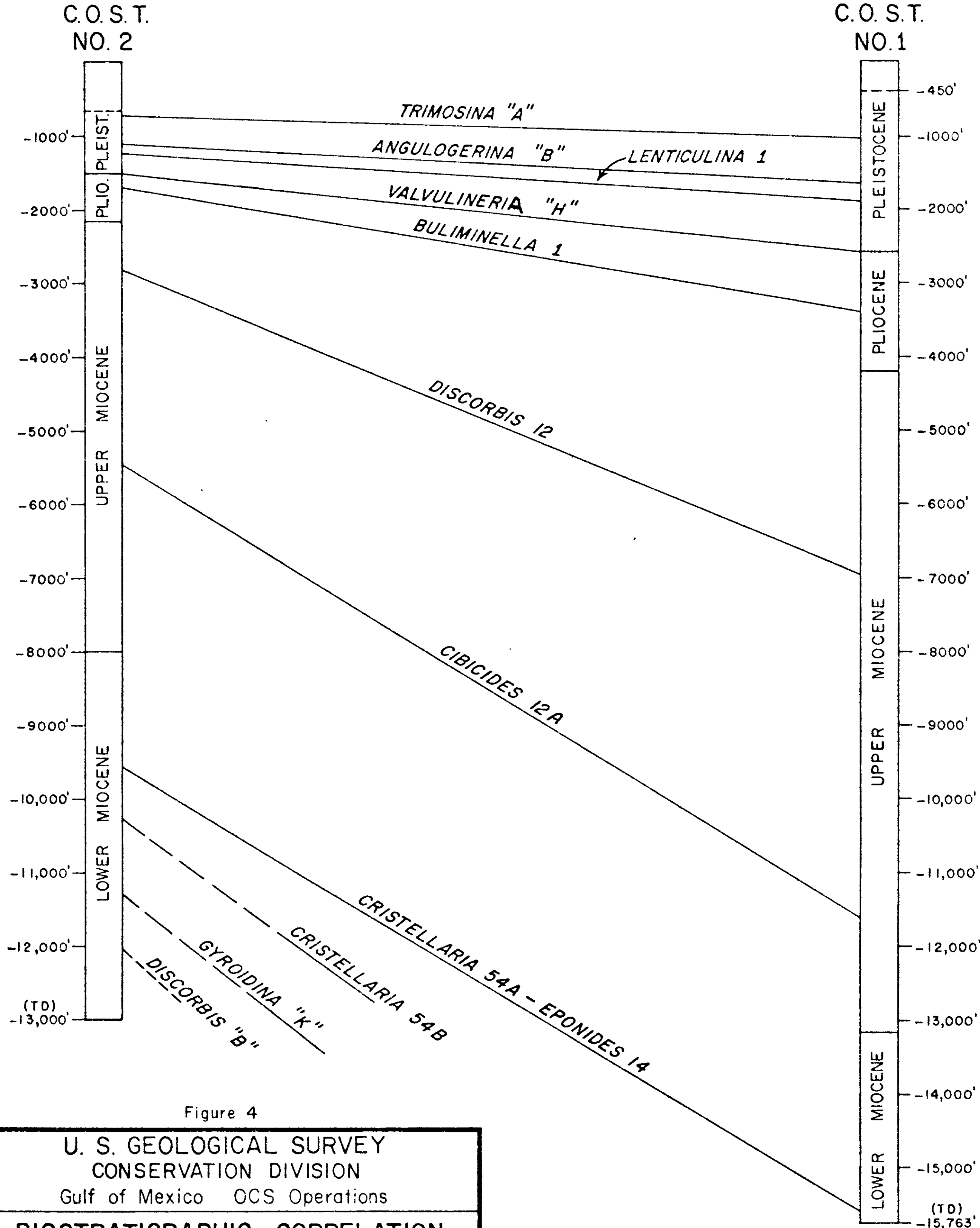

Figure 4

U. S. GEOLOGICAL SURVEY
CONSERVATION DIVISION
Gulf of Mexico OCS Operations

BIOSTRATIGRAPHIC CORRELATION BETWEEN C.O.S.T. NO. 1 & C.O.S.T. NO. 2

MUSTANG ISLAND & SO. PADRE ISLAND AREAS

SCALE. Vertical - 1" = 2000'
Horizontal - None

APRIL 1975

The Lower Miocene

The oldest sedimentary sequence penetrated in the COST NO. 2 well is of lower Miocene age. The top of lower Miocene in this well is placed at 8,000 feet, based on the first occurrences of Robulus '43' fauna. The known lower Miocene Section, consisting of the Discorbis 'B', Gyroidina 'K', Cristellaria 54B, Cristellaria 54A - Eponides 14, and Robulus 43 biostratigraphic zones, is approximately 5,000 feet thick. The paleontological examination indicates that these rocks were deposited in ecological Zone 4, an upper slope environment. The depositional environment of the COST NO. 2, appears to have been shallower, compared to the COST NO. 1, during Miocene time.

The lower Miocene rocks in the COST NO. 2 well are primarily gray marine shale with clay minerals. In addition to clay minerals, silt-size grains of quartz, feldspar, and detrital calcite make up most of the shale section. Infrequently, these shale deposits are interrupted by silty sand streaks and very thin limy sections.

Because of the distance from shore, and lateral change in lithologic characters, varying from a sedimentary sequence of alternating sand and shale in coastal areas, to a primarily shale section in the COST NO. 2 well, a direct log correlation was not possible. However, paleontological determinations and isochron correlations by means of CDP seismic lines indicate that the top of lower Miocene in the well is about 3,300 feet low with the Gulf No. 1 well in Mustang Island Block 842-L (refer to Figure 5), and about 5,200 feet high with COST NO. 1 in South Padre Island, East Addition Block 1076-L (refer to Figure 4) The cross-section in Figure 5 shows a seaward thickening of the lower Miocene biostratigraphic zones.

The Upper Miocene Section

The top of upper Miocene in COST NO. 2 well is placed at 2,180 feet, based on first occurrence of Bigenerina 'A' fauna. The total thickness of upper Miocene, consisting of Amphistegina 'B', Cibicides 12A, Bigenerina '4', Textularia 'W', Discorbis '12', and Bigenerina 'A' biostratigraphic zones, is about 5,820 feet. The paleontological examination indicates that the sediments of early upper Miocene (Amphistegina 'A' and Cibicides 12A) age were deposited in ecological Zone 4, an upper slope environment, and the sediments of late upper Miocene (Bigenerina '4', Textularia 'W', Discorbis '12', and Bigenerina 'A' age) were deposited in ecological Zone 3, an outer neritic environment. The depositional environment for the upper Miocene sediments in the COST NO. 2 well appears to have been slightly shallower than in the COST NO. 1 well.

The gross lithology of the early upper Miocene sedimentary sequence is basically the same as that of the underlying lower

Miocene. However the late Miocene, consisting of *Bigenerina* '4', *Textularia* 'W', *Discorbis* '12' and *Bigenerina* 'A' zones, is composed of a sedimentary sequence of alternating sand and shale. The sand percentage as determined from the spontaneous potential curve of the electric log shows about 15 percent sand accumulation in this section from 2,180 to 5,550 feet.

Regionally, the top of upper Miocene in the well is about 1,000 feet low with the Gulf well No. 1 in Mustang Island Block 842-L (refer to cross-section, Figure 5). It is approximately 2,760 feet high with the COST NO. 1 well in South Padre Island East Addition (refer to the paleontological correlation in Figure 4).

The Pliocene Section

The top of Pliocene in the COST NO. 2 well is placed at 1,550 feet, based on the first occurrence of *Valvulineria* 'H' fauna. It is about 600 feet low, regionally, with the Gulf well No. 1 in Mustang Island Block 842-L (refer to Figure 5), and about 1,000 feet high with the COST NO. 1 (refer to Figure 4). The Pliocene section, consisting of *Buliminella* '1' and *Valvulineria* 'H' biostratigraphic zones, is only 630 feet thick as compared to the 2,310-foot thickness in the COST NO. 1 well. The paleontological examination indicates that Pliocene sediments were deposited in ecological Zone 3, an outer neritic environment.

The gross lithology of the Pliocene section penetrated in the COST NO. 2 well may be characterized by a sedimentary sequence consisting primarily of light-to-medium gray marine shale.

The Pleistocene Section

With the exception of Holocene sediments, the youngest sedimentary sequence penetrated in the COST NO. 2 well is of Pleistocene age. The known Pleistocene section in this well is about 770 feet thick, and the gross lithology of these rocks is essentially the same as that of the underlying Pliocene sediments.

The Pleistocene section penetrated in the well is divided into three biostratigraphic zones: (1) Lenticulina '1' biostratigraphic zone of early Pleistocene age, approximately 330 feet thick, consisting of shale with occasional silty sand streaks; (2) the Angulogerina 'B' biostratigraphic zone, approximately 110 feet thick with lithology similar to that of the underlying Lenticulina '1'; (3) the Trimosina 'A' biostratigraphic zone, approximately 330 feet thick, consisting of a sedimentary sequence of alternating sand and shale.

The Pleistocene biostratigraphic zones in the COST NO. 2 well appear to be slightly thinner and structurally high compared to the COST NO. 1 in South Padre Island East Addition. The Pleistocene sediments were deposited in ecological Zone 3.

VI. PALEONTOLOGY

A summary of the paleontological sample analysis is given in TABLE IV.

VII. GEOPHYSICS

The area surrounding the COST NO. 2 well location was mapped prior to the South Texas OCS Lease Sale by Petty-Ray Geophysical, Inc., under USGS Contract No. 14-08-0001-13508. The seismic interpretation maps prepared by Petty-Ray were based on a 2 x 2-mile seismic data grid, acquired by Teledyne Exploration Company in 1973, and purchased by the USGS from Teledyne under Contract No. 14-08-0001-13566. In the vicinity of the well, Petty-Ray's interpretation consisted of mapping two structural levels, an upper and lower Miocene horizon.

The COST NO. 2 well is located in Block A-29 of the Mustang Island Area, 2,200 feet northwest of the intersection of Teledyne seismic lines 444 and 427. As seen in Figure 1, the COST NO. 2 well lies about 61.5 miles north of the COST NO. 1 well. The structure in the area of the COST NO. 2 well is similar to that surrounding the COST NO. 1 well. Regionally there is a gentle, eastward dip to the bedding, and these beds are traversed by several north-northeast trending fault systems. The nearest fault to the COST NO. 2 well is a north-northeast trending down-to-the-east fault, 6,000 feet east of the well, at a depth of approximately 2,500 feet.

MUSTANG ISLAND AREA
BLOCK A-29 UNLEASED
SUPERIOR
COST #2
PALEONTOLOGICAL SUMMARY REPORT

780'	Trimosina "A"	Ecologic Zone 3
1110'	Angulogerina "B"	Ecologic Zone 3
1220'	Lenticulina 1 Fauna	Ecologic Zone 3
1550'	Valvulineria "H" Fauna	Ecologic Zone 3
1700'	Buliminella 1	Ecologic Zone 3
2180'	Bigenerina "A"	Ecologic Zone 3
2810'	Discorbis 12	Ecologic Zone
	Textularia "L" and Bigenerina 2	not developed
4010'	Textularia "W"	Ecologic Zone 3
4400'	Bigenerina 4	Ecologic Zone 3
5540'	Cibicides 12A rare	Ecologic Zone 4
6050'	Cibicides 12A common	Ecologic Zone 4
7610'	Amphistegina "B" Fauna	Ecologic Zone 4
8000'	Robulus 43	Ecologic Zone 4
9650'	Cristellaria 54A-Eponides 14	Ecologic Zone 4
10280'	Cristellaria 54B	Ecologic Zone 4
11240'	Gyroidina "K"	Ecologic Zone 4
12020'	Discorbis "B"	Ecologic Zone 4

Seismic/stratigraphic correlations were performed between the COST NO. 2 well and the Gulf No. 1 well in Mustang Island Block 842-L. Teledyne seismic line 444 was utilized in this correlation. The index map, Figure 1, shows the locations of the two wells and this seismic line.

In the geophysical analysis, the depths of the paleo markers were plotted on the seismic section using well velocity data derived from the Teledyne automatic velocity analyses printouts. By having well data at each end of the line,it was possible to account seismically for the geologic section along the line, just as was done for the earlier COST NO. 1 well report. Unfortunately there was no paleo control on the Gulf No. 1 well above 3,500 feet, so it was necessary to depend totally on the seismic lines for control in the shallow part of the section.

The resulting geologic cross section appears in Figure 5.

Examination of the SP logs for these two wells suggests that the upper portion of each passes through a sequence of interbedded sand and shale lenses on the order of 30 to 100 feet thick, totalling about 7,200 feet in the Gulf No. 1 well and 5,300 feet in the COST NO. 2. Below this sand-shale sequence, the COST NO. 2 contains principally shale; whereas,the Gulf well contains shale with occasional sand lenses. Using the information from the SP logs as a base, the Teledyne automatic velocity analyses were evaluated to estimate the occurrence of sand lenses in the cross-section between the two wells. Special attention was paid to the display of relative cross-power. According to Teledyne, relative cross-power "is a measure of the strength of the reflection data supplying the velocity information". Since the strength of a seismic reflection should be greatest where a sharp density contrast occurs (at a sand-shale interface, for example),the relative cross-power peaks were correlated as possible indicators of the presence of sand lenses. Unfortunately, the automatic velocity analysis nearest the COST NO. 2 well was not available for this study. The relative cross-power functions and resulting pattern of predicted sands appears in Figure 6.

The RMS velocity function was also interpreted for the nearest available,automatic velocity analysis to the Gulf No. 1 and the COST NO. 2 wells. All of these were plotted on the same set of coordinates, and appear in Figure 7. The RMS velocity function from the automatic velocity analysis of a previous USGS interpretation nearest the COST NO. 2 well was also plotted. It can be seen that there is no significant difference between these three curves, suggesting that there is little significant difference in the RMS velocity function between the Gulf No. 1 and the COST NO. 2 wells, a distance of about 31.5 miles. However, an examination of the relative power curves and the two electrical logs shown on Figure 6 indicates that stratigraphic variations do occur along this 31.5 miles.

For comparison,the USGS interpretation of the RMS velocity function for the nearest automatic velocity analysis to COST NO.1 was plotted on the same set of coordinates (Figure 7). From this comparison it can be seen that the seismic waves travelled at a significantly greater velocity, through the sediments below 2,500 feet (Discorbis '12'), in the COST NO. 2 well than in the COST NO. 1. This may be an indication of the greater amount of sand encountered in the COST NO. 2 well; or it may indicate a greater degree of compaction in the shales penetrated by the COST NO. 2.

Consideration was also given to the COST NO. 2 sonic log. From this data a time-depth velocity curve was constructed and appears in Figure 8. The values on this curve are in close agreement with those obtained by the USGS interpretation of the Teledyne automatic velocity analysis, as well as the Petty-Ray time-depth values in thevicinity of the well. Slope changes in the time-depth curves and seismic interval velocity inversions were noted at the following depths for both the sonic log data and the USGS data derived from the automatic velocity analyses:

VELOCITY-TIME SLOPE CHANGES

Approx. Depth	Sonic Log	Automatic Velocity Analysis	Paleo Significance
1400'		x	Top of Miocene (Bigenerina 'A')
2800'	x		Top Discorbis '12' zone

Approx. Depth	Sonic Log	Automatic Velocity Analysis	Paleo Significance
3550'	x	x	
5181'	x	x	Base of sand-shale sequence
6426'	x	x	
8590'	x	x	Approx.Mid. Robulus 43 Zone
9282'		x	Approx. top Cristel-laria '54A' zone
10900'	x		Approx. top Gyroidina 'K' zone
12628'		x	

INTERVAL VELOCITY INVERSIONS

1400'	x		Basal Nebraskan (Valvulineria 'H' Fauna)
3200'	x		
5100'	x		Base of sand-shale sequence
5900'	x	x	Top of Cibicides 12A zone
10100'	x		Top of Cristellaria '54 A-Eponides 14
11900'	x		Top of Cristellaria 'A' (Discorbis 'B')
12628'		x	

From the above, it is evident that most of the points where velocity changes occur are identifiable with distinct horizons in this section.

VIII. ENVIRONMENTAL CONSIDERATIONS

The Director of the Geological Survey in November 1974 informed the Secretary of the Interior that the proposal to conduct a second deep stratigraphic test did not constitute a major Federal action and therefore did not require an Environmental Impact Statement. An Environmental Analysis of the project area was filed with the permit.

The drilling site was located 42 miles from land,thereby prohibiting any adverse impact upon the coastal zone. The discharged drill cuttings were allowed to settle through the water column. This probably resulted in a widespread dispersal reducing the possibility of concentrated piles of cuttings which could smother faunal communities. Any possible toxic effects from drilling fluids were probably eliminated by the extreme dilution produced in the Gulf waters.

There were a few minor hydrocarbon shows, but no liquid hydrocarbons were introduced into the sea.

Any interruption to commercial fishing or shrimping activities in the area was temporary and ceased to exist when the rig was removed from location. Any interruption to military activities was temporary and synchronized by prior agreement with military authorities. The drill site was approximately eight miles east of the shipping fairway and therefore did not interfere with shipping activities.

The hole was plugged and abandoned. All subsurface casing was cut off a minimum of 20 feet below the mud line, and the area was dragged to check for bottom obstructions. There were none.

No long-term, adverse environmental impacts resulted from this drilling operation, and any short-term effects have been eliminated by the cessation of activities.

IX. CONCLUSIONS

The COST NO. 2 well was drilled to a total depth of 13,000 feet and abandoned in the lower Miocene.

The stratigraphic column penetrated in the subject well is similar in some respects to that of the COST NO. 1 well in South Padre Island, East Addition. With the exception of some Holocene sediments, the stratigraphic section penetrated in the COST NO. 2 well consists of Pleistocene, Pliocene,and Miocene rocks. Although the gross lithology of these rocks is characterized by a clastic sequence of alternating shale with fine-grain sand sections, very few sands were encountered in the Miocene below 5,500 feet. The late Miocene and the younger sedimentary sequences appear to have 10 to 15 percent sand as determined from the spontaneous potential curve of the electric log.

The massive grey shale of early Miocene is infrequently interrupted by very thin limy , and fine-grained sand sections with no apparent reservoir potentials. The sonic log interpretations indicate that the shaly sedimentary sections down to 9,300 feet in the COST NO. 2 well are relatively under-compacted and highly porous. Below 10,310 feet, the sediments appear to be highly compacted.

A summary of the qualitative assessment of petroleum potentials based on information from the COST NO. 2 well is given below for the Pleistocene, Pliocene, and Miocene sections in the Mustang Island OCS Area.

PLEISTOCENE SECTION: 780 feet - 1,550 feet

The reservoir rock characteristics of the Pleistocene sedimentary sequence penetrated in the COST NO. 2 well are very similar to those of theCOST NO. 1. The early Pleistocene rocks of the *Lenticulina* '1'and *Angulogerina* 'B' biostratigraphic zones are composed primarily of shale with silty sand sections. The Pleistocene sediments of the *Trimosina* 'A' biostratigraphic zone consist of a sedimentary sequence of alternating shaly sand and shale.

The Pleistocene deposits, however, as mentioned in an earlier report on the COST NO. 1 well, were controlled by the sea level, which fluctuated from low stages during glacial periods to high stages during interglacial periods. Consequently, stratigraphic and lithologic conditions may vary laterally and some sediments could be prospective in localized areas of the south Texas OCS. The nearest Pleistocene production, to date, is confined to the High Island and Galveston OCS Areas of the east Texas OCS.

PLIOCENE SECTION: 1,550 feet - 2,180 feet

The Pliocene sediments, offshore Texas, have not been prolific oil and gas producers. The stratigraphic tests (COST NO. 1 and NO. 2) probably confirm that these rocks for the most part are lacking necessary sandstone reservoir characteristics in the south Texas OCS. The Pliocene section penetrated in the COST NO. 2 is only 630 feet thick, and the sedimentary sequence is composed of shale with some silty sand sections with poor reservoir characteristics. Favorable conditions for any sizeable hydrocarbon accumulation evidently did not exist on the Texas Continental Shelf during Pliocene time.

MIOCENE SECTION: 2,180 feet - 13,000 (T.D.)

The Miocene section penetrated in the COST NO. 2 well is about 10,820 feet thick, and for the most part is composed of light-to-medium-grey shale. The sand sections in the upper Miocene have the necessary reservoir rock qualities, and are considered to be prospective on structures adjacent to the subject well.

The production from Miocene rocks occurs along the Texas Coast both onshore and offshore, and the reservoir potentials are expected to extend downdip into Federal waters in the Mustang Island Area.

Although the lower Miocene and early upper Miocene rocks penetrated in the COST NO. 2 well show relatively poor reservoir characteristics, good sand conditions appear to exist landward of the well (refer to the seismic interpretation in Figure 6). The sedimentary rocks of late Miocene (i.e., Bigenerina '4', Textularia 'W', Discorbis '12' , and Bigenerina 'A' biostratigraphic zones) penetrated in the COST NO. 2 well show fairly good reservoir rock characteristics, and therefore these sediments may be considered to be prospective.

The Miocene-Pliocene stratigraphic sections penetrated in the COST NO. 2 well are relatively thinner and structurally high compared to that of the COST NO. 1 well in the South Padre Island Area. This may be a reflection of a greater subsidence of the South Padre Island Area relative to Mustang Island during Miocene-Pliocene time. The relative subsidence between the two areas could have been controlled by regional structural elements (the San Marcos Arch and the Rio Grande Embayment) that existed at the beginning of the Cenozoic Era, and affected the Tertiary sedimentary depositional pattern along the Texas Coast. However, the offshore extent of these structural elements and their effects on late Tertiary deposition are not fully known.

The results from the two deep stratigraphic tests (COST NO. 1 and NO. 2), offshore south Texas show that the sedimentary rocks penetrated in these wells are essentially lacking potential reservoir sand characteristics. In general, this may reflect that little coarse material (sand) was available to this gradually subsiding area during the late Tertiary and Quaternary Periods.

Since Miocene and Pliocene depocenters were located east of the Sabine Arch, it seems that little coarse material was being carried across the arch into the Texas shelf by longshore currents. The Texas streams were probably not large enough to build large deltas. Much of the sand brought down by these rivers was probably carried away from the deltas by longshore currents and deposited on beaches and offshore bars in shallow marine and transitional environments. Only fine sediments were apparently transported to the outer shelf and slope areas during most of Miocene-Pliocene time.