THE FLORIDA STATE UNIVERSITY

COLLEGE OF ARTS AND SCIENCES

PRE-HAYNESVILLE STRATIGRAPHY AND STRUCTURAL GEOLOGY OF THE APALACHICOLA EMBAYMENT: PETROLOGY AND PALEOENVIRONMENTAL INTERPRETATION OF THE SMACKOVER FORMATION.

by

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the Department of Geology
in partial fulfillment of the
requirements for the degree of
Master of Science

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INTRODUCTION

The Jurassic rocks in the northern Gulf Coast Basin are entirely subsurface units. The Upper Jurassic is composed, in descending order, of (1) the Bossier and Schuler Formations (Cotton Valley Group); (2) the Haynesville Formation (including the Lower Haynesville Buckner Member); and (3) the Smackover Formation. The Middle Jurassic includes the Norphlet Formation and underlying Louann Salt. The next units in a complete section are the Eagle Mills Formation (Triassic), Paleozoics, and basement.

The purpose of this project is to outline the lithologic history of the Smackover Formation and the structural and stratigraphic geology of other pre-Haynesville sediments in the Apalachicola Embayment. The Apalachicola Embayment is approximately centered along the present day Apalachicola River, and includes all of Gulf and parts of Bay, Calhoun, Franklin and Liberty Counties (figure 1).

The goal of this study is to attain a better understanding of the depositional and diagenetic history of the Smackover Formation in the Apalachicola Embayment. The Smackover Formation is a prolific

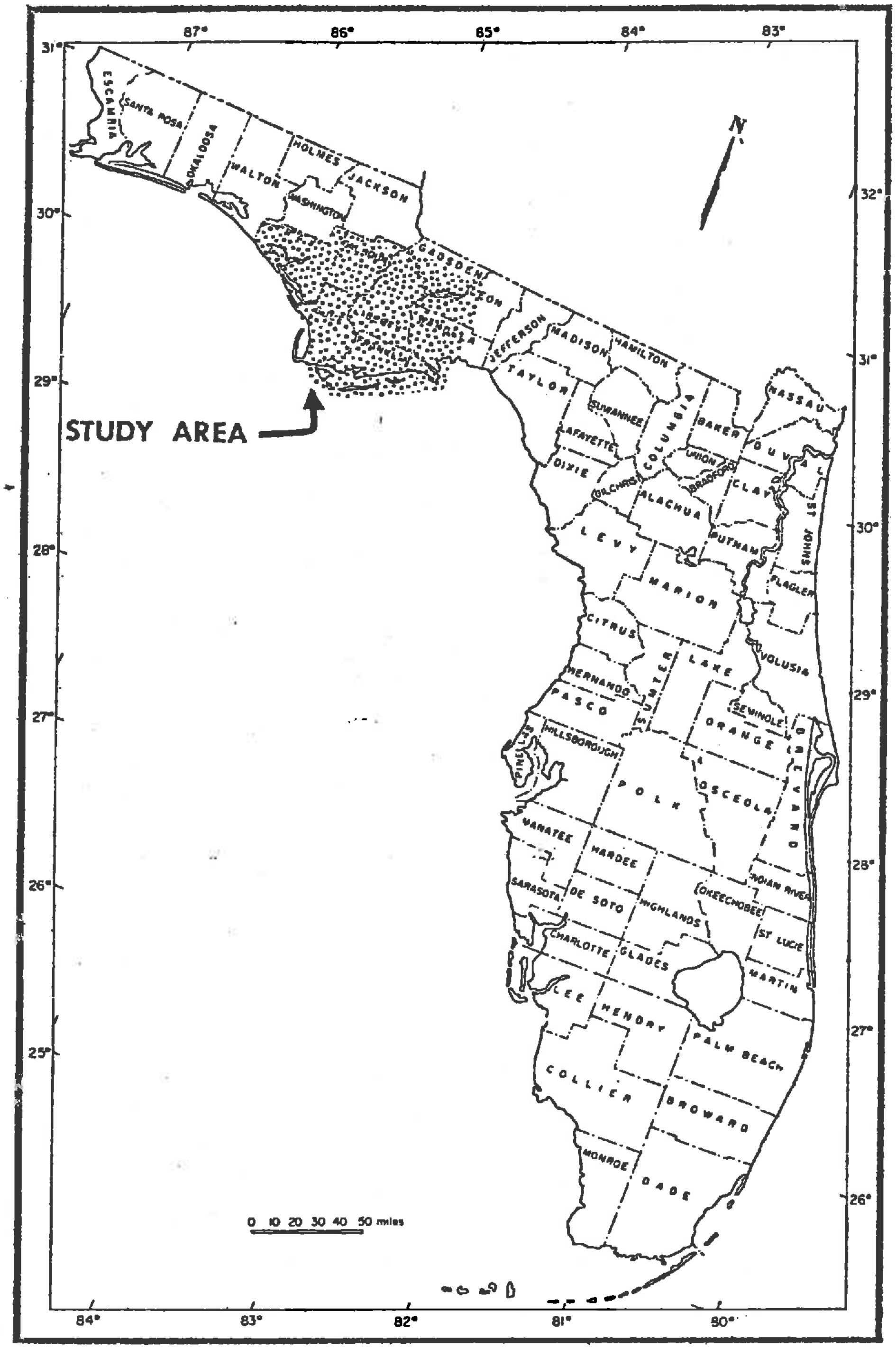


Figure 1 - Study Area Location Map

hydrocarbon bearing unit throughout the northern Gulf Coast Basin. This study may help in the delineation of those areas where favorable exploration efforts may continue.

PREVIOUS WORK

REGIONAL STRATIGRAPHY

Eagle Mills Formation

The Eagle Mills Formation was named for a subsurface unit in southern Arkansas. The term was adopted by the Shreveport Geological Society in 1937 (Scott et al, 1961) for all pre-Smackover, post-Paleozoic units of south Arkansas. The unit has been redefined by various authors through the years, and the reader is directed to Scott et al (1961) for a historical review. The Eagle Mills Formation type well is the Amerada Petroleum Company et al No. 1 Eagle Mills, Sec. 11, T. 12S, R. 16W., Ouachita County, Arkansas.

The age of the Eagle Mills, based on a single leaf of a cycad, *Macrotaeniopteris magnifolia*, is Triassic, (Scott et al, 1961). The Eagle Mills consist of non-marine red beds, gray and white siltstones and sandstones with associated diabase intrusions (Scott et al, 1961).

Stratigraphically the Eagle Mills rest unconformably upon Paleozoic sedimentary rocks and basement rocks. The unit is overlain by various units throughout the northern Gulf Coast, including the Louann Salt, the Norphlet Formation, the Smackover Formation, and various other units of lower Cretaceous age.

The thickest accumulations have been found in grabens and half grabens (Scott et al, 1961). The unit has been found in wells in Arkansas at depths ranging from 305 meters (1000 feet) to 2,743 meters (9000 feet). The Eagle Mills has been reported from east Texas across the northern Gulf Coast into northwest Florida (Scott et al, 1961; Applegate, Pontigo and Rooke, 1978).

Louann Salt

The Louann Salt was named for a subsurface unit in Arkansas, Louisiana and Texas. The type section is in the Gulf Regining Co. No. 1 Werner Saw Mill Company well, Union County, Arkansas (Lexicon, 1966).

The Louann Salt has been redefined by various authors who have placed its age from Permian to Late Jurassic (Imlay, 1980). Kirkland and Gerhard (1971) place the age of the Louann Salt as no older than Middle Jurassic based on a study of palynomorphs obtained from cap rock overlying halite on the Challenger Knoll in the Sigsbee abyssal plain in the central Gulf of Mexico.

The thickness of the Louann salt in the type well is 261 meters (857 feet) but may be considerably thicker in localized areas. Hughes (1968), studying salt-related fault structures, indicated that some of the "high-relief anticlines" have well over 3,050 meters (10,000 feet) of salt.

Stratigraphically (in the Northern Gulf Coast), the Louann Salt rest unconformably upon basement, Paleozoic sedimentary rocks and the

Triassic Eagle Mills Formation (Bishop, 1968; Hughes, 1968; Sigsby, 1976; Imlay, 1980).

Norphlet Formation

The Norphlet Formation was first named the Norphlet tongue by Imlay (1940), for upper beds of the Eagle Mills Formation (Triassic). Hazzard et al (1947) (Lexicon, 1966) replaced the Norphelt tongue with Norphlet Formation. The type section is found in the Gulf Regining Company No. 49-1 Werner Saw Mill Company well, in Union County, Arkansas (Lexicon, 1966).

The Norphlet Formation consists predominantly of red silty shale, siltstone and sandstone units (Dickinson, 1968). Occasionally, white sandstone units are present, as in northwest Florida. Norphlet shale units vary from gray, dark red to bright red and are silty and micaceous in local areas (Imlay, 1943; Dickinson, 1968; Sigsby, 1976). The Norphlet sandstone is usually poorly sorted, but varies from poorly-sorted to well-sorted. The sandstone units are sometimes conglomeratic, especially around the updip limits of deposition (Dickinson, 1968). In Alabama and northwest Florida, sedimentary grains of igneous material have been encountered, probably as a direct result of proximity to the Appalachian folded belt (Sigsby, 1976).

The thickness of the Norphlet Formation ranges from 4.5 meters (15 feet) to 21.2 meters (70 feet) in the Arkansas - Louisiana - Texas area (Dickinson, 1968). In Mississippi and western Alabama, the average thickness of the Norphlet is around 30.3 meters (100 feet) (Oxley et al, 1967). In northwest Florida, the Norphlet attains thicknesses of 76.2 meters (250 feet) in the updip (north) shelf area and 244 meters (800 feet) downdip (south) towards the basin (Sigsby, 1976).

Smackover Formation

The Smackover Formation was named after the Smackover oil field in Union County, Arkansas. It was first described from the Lion Oil Refining Company, Hayes No. 9-A Well, Sec. 9, T. 16S, R. 15W.

The Smackover was reported in 1937 by D. H. Binghan (Lexicon, 1966) as having been encountered at a depth of 1493.5 meters (4,900 feet) at the north edge of Smackover Field. The limestone was 123 meters (700 feet) thick and the age was undetermined. It was thought to be lower than Trinity (Cretaceous) and younger than the Paleozoic.

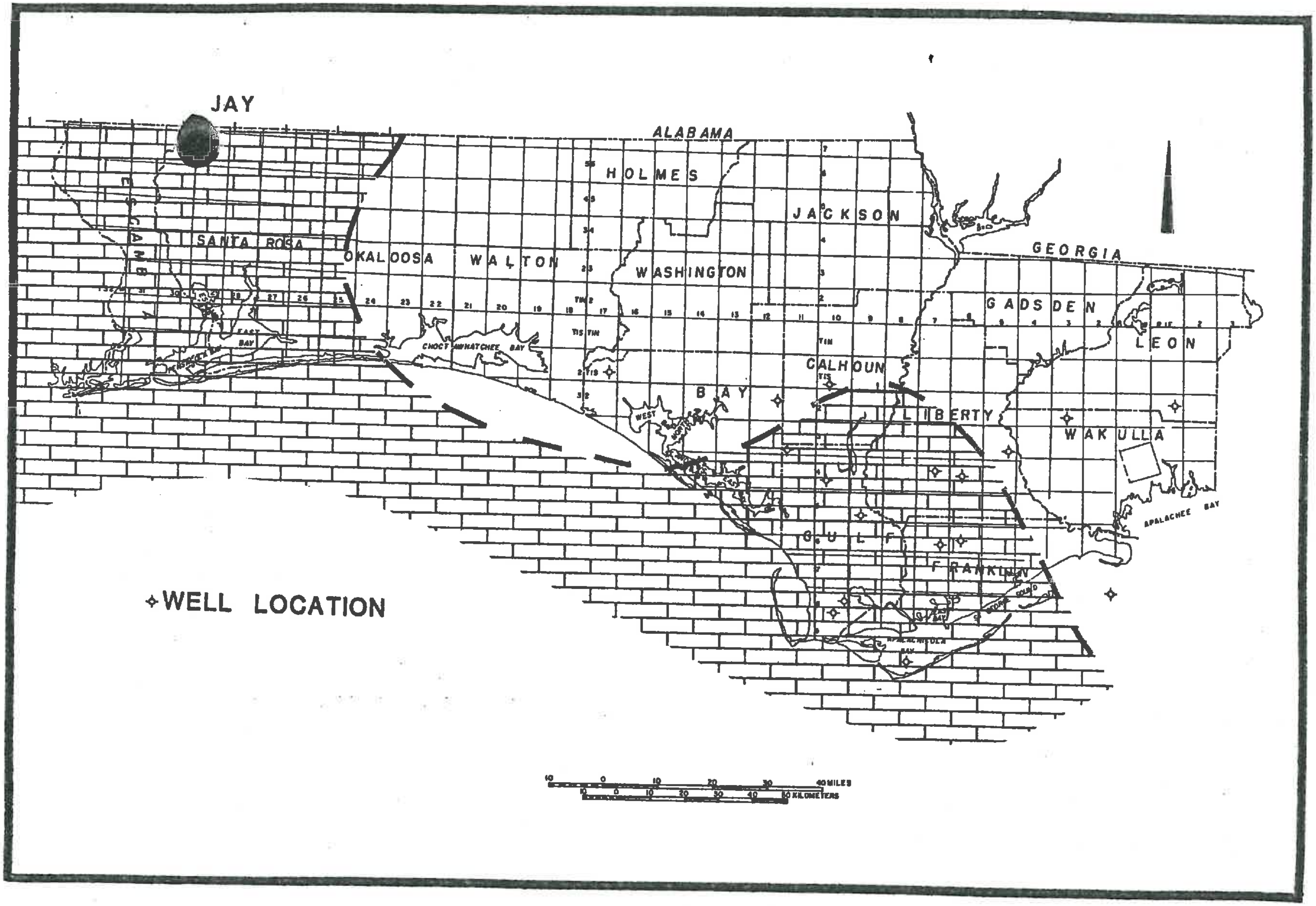
The Smackover was termed a formation by R.W. Imlay in 1940, with fossils indicating Middle or Upper Jurassic age. In 1943, Imlay reported the Smackover as Upper Jurassic (Argovian).

Sigsby (1976) reported on the Smackover in the Big Escambia Creek (Alabama), Jay (extreme northwest Florida) field area (see figure 2), as Upper Jurassic (Oxfordian).

The Smackover Formation has been subdivided into three members by various authors, but due to

FIGURE 2

Area underlain by Smackover sediments (limestone pattern). The Conecuh embayment is located in Escambia and Santa Rosa Counties, the Apalachicola Embayment emcompases all of Gulf, and parts of Bay, Calhoun, Liberty, and Franklin Counties. Jay - Blackjack fields is closest hydrocarbon producing area to area of study.


JAY
ALABAMA
GEORGIA
ESCAMBIA
SANTA ROSA
OKALOOSA
WALTON
HOLMES
WASHINGTON
JACKSON
BAY
CALHOUN
GADSDEN
LEON
LIBERTY
WAKULLA
GULF
FRANKLIN
CHOCTAWHATCHEE BAY
EAST BAY
WEST BAY
APALACHICOLA BAY
APALACHEE BAY
WELL LOCATION
40 MILES
50 KILOMETERS

lateral and basinward facies variations, only an upper and lower member are used in this report. The uppermost Reynolds Oolite member will not be used in this report.

The Smackover Formation is predominantly a carbonate wedge which attains great thickness in relatively short distances basinward. Thicknesses of 242.2 meters (800 feet) to 363.6 meters (1200 feet) are common in Louisiana (Bishop, 1968), Texas and extreme southern Arkansas areas (Dickinson, 1968).

Lower Member

The lower member of the Smackover Formation is composed of dense, dark brown, silty to argillaceous, slightly fossiliferous limestone, mudstone and calcareous siltstone, with varying amounts of dolomite. The lower member, which grades upward into the Bossier Formation of the Cotton Valley Group in Texas and Louisiana, was deposited on a quiet neritic shelf in restricted seas (Bishop, 1968). Some terrigenous detrital material entered the area during deposition as evidenced by the presence of thin shale beds intercalated with "shaly" limestone units (Bishop, 1968).

Toward Mississippi, Arkansas and Louisiana the lower member is predominantly a thick clastic sequence of probably deltaic origin. These sandstone units vary from porous to non-porous, and fine to coarse grained. Many grains are frosted or etched, and rounded to subrounded. The sands were probably a product of transportation by a distributary system which closely paralleled the present day Mississippi River (Bishop, 1968). The flood of fresh water entering the "Smackover Sea" in this area inferrably prevented the deposition of limestone. Dark brown dense limestone was deposited in the adjacent areas (Dinkins, 1968) around the delta system.

Further east, in Mississippi, dense dark brown limestone is found interbedded with thick clastic units, like the ones described previously, probably as a result of long-shore currents or a possible larger distributary system supplying sand to eastern Mississippi and western Alabama (Dinkins, 1968; Bishop, 1968).

Upper Member

The lithology of the upper member is more variable than the underlying lower member, varying from oolitic limestone to dolomitic limestone to sandstone (Bishop, 1968).

The upper member in the Arkansas shelf consists of an oolitic calcarenite (Bishop, 1968), which thins south toward Louisiana. In east Texas, dolomitization of the Smackover is widespread, resulting in sucrosic dolomites (Dickinson, 1969). In parts of western Mississippi, eastern Arkansas and Louisiana, the member is composed of calcarenitic or sandy limestone with some shale and sandstone beds (Bishop, 1968).

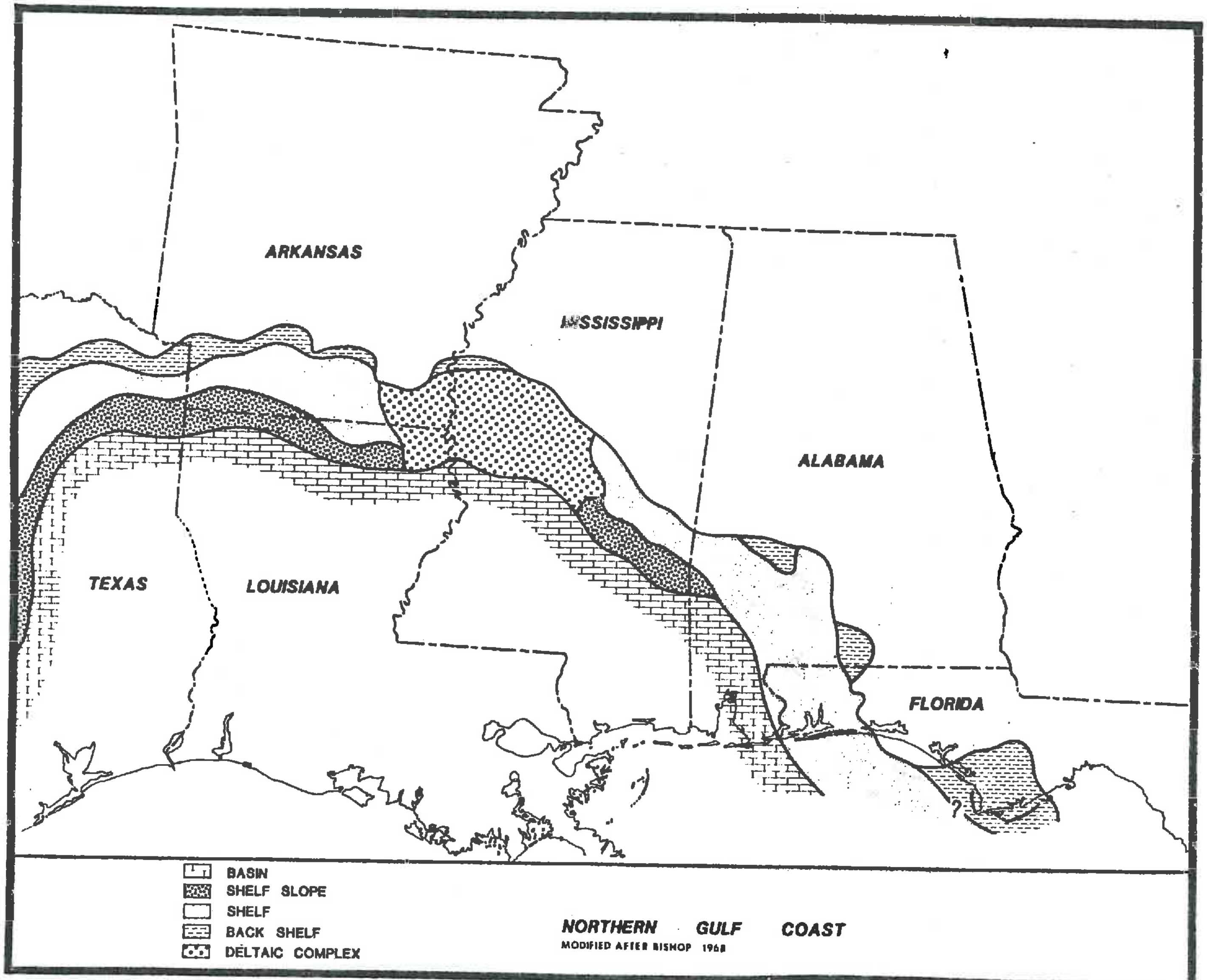
Further east (figure 3), a clean massive sandstone was deposited by one of the streams draining the interior of the continent (Bishop, 1968).

The thickness of the upper member of the Smackover Formation ranges from 0 to 78.8 meters (260 feet) in southern Arkansas and Louisiana. In Mississippi and Alabama, the Smackover varies from a very thin unit at its updip limits to 90.9

F I G U R E 3

Regional map from east Texas to northwest Florida, showing distribution of inferred paleoenvironments during deposition of the Upper Smackover. Modified after Bishop, 1968.

46 17


ARKANSAS
MISSISSIPPI
ALABAMA
TEXAS
LOUISIANA
FLORIDA
BASIN
SHELF SLOPE
SHELF
BACK SHELF
DELTAIC COMPLEX
NORTHERN GULF COAST
MODIFIED AFTER BISHOP 1968

meters (300 feet) (Oxley et al, 1967) in a relatively short distance. In northwest Florida, the Smackover ranges in thickness from 75.7 meters (250 feet) to 121.2 meters (400 feet).

In Texas and Arkansas the updip depositional limit of the upper member was just a few miles north of the present subcrop, as indicated by rate of thinning and change in lithology from a shelf environment to a back-shelf environment (figure 3) (Bishop, 1968).

The facies change between Mississippi and northwest Florida and Alabama was due to the wide shelf present in the latter two states. This wide shelf slowed the wave-action so that deposition of oolites was minimal; instead, a low energy, pelletal and pelletal-micritic dolomite facies was deposited (Sigsby, 1976).

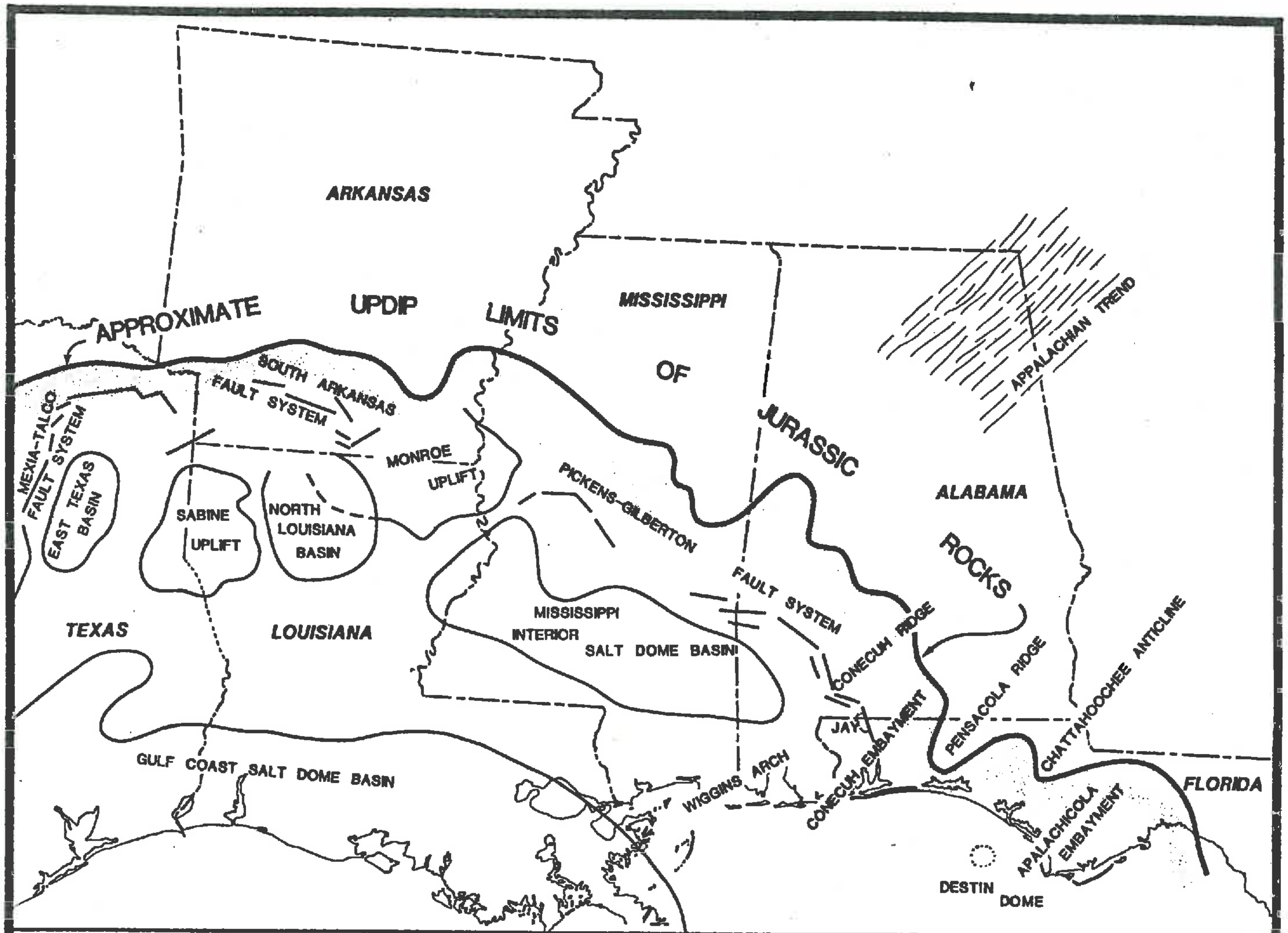
STRUCTURAL SETTING OF NORTHERN GULF COAST BASIN

The Northern Gulf Coast basin, a term usually applied to that area which is roughly outlined by the up-dip limits of Jurassic sediments (Beall, 1973), extends from east Texas to northwest Florida (figure 4). The most common form of structural deformation affecting Mesozoic strata in the Gulf Coast basin is normal faulting (Beall, 1973). These faults usually dip (toward the coast) at an angle of 40°-50° in the upper Cretaceous strata, steepening with depth and often reaching angles of 70° or more in the Jurassic (Beall, 1973).

An almost continuous "hinge-line" is formed by a group of geographically related faults. South of this "hinge-line" Jurassic sediments are considerably thicker than their northern counterparts (Dickinson, 1968; Hughes, 1968; Beall, 1973; Sigsby, 1976; Mancini, 1980). The faults which comprise this zone include: the Mexica-Talco fault system (figure 4) bordering the east Texas salt basin; the south Arkansas fault system from the southwest corner of Arkansas to south-central Arkansas; the Pickens fault system in western

FIGURE 4

Regional map from east Texas to northwest Florida. Structural Setting of Northern Gulf Coast Basin, showing major structural features and part basins.



NORTHERN GULF COAST

MODIFIED AFTER DICKINSON 1968

21

Mississippi, on the northern edge of the Mississippi Interior Salt Dome Basin; the Gilberton-West Bend fault zone (Wilson, 1975) of eastern Mississippi, western Alabama and the Pollard-Foshee fault system of southern Alabama, northwest Florida.

Major positive features found in the northern Gulf Coast Basin are the gently dipping Sabine uplift of east Texas, western Louisiana and the Monroe uplift in southern Arkansas, northern Louisiana (Beall, 1973; Dickinson, 1968). The Conecuh Ridge - Wiggins uplift (figure 4) in southern Alabama (Mancini, 1980), the Pensacola Arch and the Appalachian structural trend (Sigsby, 1976) had significant influence on the distribution of Jurassic sediments and served as the source areas for some of the basal Jurassic clastics as well as the clastics of the Smackover Formation.

Mancini (1980), found that the Smackover Formation is anomously "thin," 30 meters (100 feet) or less, over the Conecuh ridge - Wiggins uplift. He postulated that the Conecuh ridge - Wiggins uplift was a "paleo-high" and probably "acted as a barrier in inhibiting ocean circulation in the Manila embayment area."

The structural effects of the Louann Salt are both widespread and complex (Oxley et al, 1967). Various types of salt-related structures have been documented by Hughes (1968). The farthest up-dip structures were formed by flowage of the salt toward the up-dip limits developing salt ridges, parellel to the wedgeout and located immediately basinward (Hughes, 1968). Associated with this salt system is a graben system caused by stress created by the salt movement adjacent to a stable floor (Hughes, 1968). Down-Dip from these structures, the salt attains greater thickness, and intermediate (+1525 meters; 5000 feet) and high relief (+3050 meters; 10,000 feet) anticlines are formed, in response to lateral migration of the thicker salt.

Sigsby (1976), working in the Conecuh embayment found that structural movement in response to salt migration, was initiated after a relatively thin overburden was deposited. Sigsby also postulated that there had been pre-Louann faulting based on differential thickening of the salt. He found that the Louann Salt was approximately 213 meters (700 feet) thicker on the downthrown block.

Other tectonic elements found near the Apalachicola embayment include the Destin Dome and Peninsular Arch. Antoine (1965) thought that this feature was either associated with igneous activity or a "deep-seated salt swell." The Sun Oil Company OCS-G 2490 well in the Destin Dome area encountered Louann Salt at -5,320 meters (-17,454 feet), which would suggest a deep-seated salt related feature. East of the Apalachicola embayment, about 100 kilometers (65 miles) to 130 kilometers (80 miles) is the Peninsular Arch (Applin, 1951) of the Florida Peninsula. Barnett (1975) described the Peninsular Arch as an eroded and faulted crustal block, probably uplifted during the late Paleozoic.

Methods of Study

Sixteen deep oil tests have been drilled in Bay, Calhoun, Franklin, Gulf, Liberty and Wakulla counties (Tables 1 and 2) Florida. Ten of these wells penetrated the Smackover Formation in what is known as the Apalachicola embayment.

All wells used in this study have geophysical logs. These include electric and in some cases sonic logs. "An electric log is a continuous record of the electrical properties of the formations and the fluids penetrated in a well" (Levorsen 1967 p. 77). Electric logs are made by running electrodes in an insulated device called a sonde, down the well hole. (Leversen, 1967; Schlumberger, 1974). Nearly all well logs are recorded on film as a galvanometer deflection versus depth (Schlumberger, 1974). Sonic logs are a continuous record of the time required for a compressional sound wave to traverse one foot of formation (Levorsen, 1967; Schlumberger, 1974). The interval transit time is the reciprocal of the velocity of the compressional sound wave (Levorsen, 1967; Schlumberger, 1974). The width of the recorded film is 8.25 inches the log is divided into three curve tracks and a narrower track

T A B L E 1

WELLS PENETRATING THE SMACKOVER FORMATION IN AREA OF STUDY

	PERMIT NO.	COMPANY		FEE NAME	COUNTY	LOCATION SEC.	LOCATION TWP.	LOCATION RGE.	TOTAL DEPTH
W-8487	387	Mobil Oil Corp.	1C	FL State Lease 224A	Franklin*	Lat 29 Long 85	37' 00'	54"N 06"W	14,369
W-12483	670	Charter Expl. Co.	1	St. Joe Paper Co.	Gulf	26	8S	10W	14,297
W-12497	745	Placid Oil Co.	16-3	U.S.A.	Liberty	16	4S	6W	12,400
W-12509	746	Hunt Oil Co.	1	Int. Paper Co.	Gulf	30	3S	11W	13,284
W-12617	762	Charter Expl. Co.	6	St. Joe Paper Co.	Gulf	12	8S	10W	14,570
W-12739	769	Placid Oil Co.	10-3	U.S.A.	Liberty	10	4S	7W	12,654
W-13530	814	Exxon Corp.	16-3	Buckeye Cell. Corp.	Franklin	16	6S	6W	11,950
W-13341	846	Exxon Corp.	20-3	Neal Lumb. & Mfg. Co.	Gulf	20	4S	10W	13,587
W-14173	957	Mesa Pet. Co.	29-4	St. Joe Paper Co.	Gulf	29	5S	9W	14,186
W-14231	960	Mesa Pet. Co.	23-1	Buckeye Cell. Corp.	Franklin	23	6S	7W	12,885

* Offshore

T A B L E 2

OTHER WELLS USED TO DELINEATE LIMITS OF SMACKOVER FORMATION AND LOUANN SALT

	PERMIT NO.	COMPANY		FEE NAME	COUNTY	LOCATION SEC.	LOCATION TWP.	LOCATION RGE.	TOTAL DEPTH
W-5654	293	Cal. Coastal Pet.	1	FL State Lease 224A	Franklin*	Lat 29 Long 84	47' 22'	29.6"N 42.5"W	10,560
W-12498	690	Charter Expl. Co.	2	St. Joe Paper Co.	Bay	27	1S	17W	12,313
W-12114	696	Placid Oil Co.	27-2	U.S.A.	Wakulla	27	2S	3W	11,747
W-12496	730	Placid Oil Co.	26-4	U.S.A.	Liberty	26	3S	5W	12,131
W-12812	777	Mallard Expl. Inc.	31-2	Int. Paper Co.	Calhoun	31	1S	10W	12,140
W-14614	1010	Houston Oil & Min.	13-3	S. W. Forest Ind.	Bay	13	2S	12W	12,486

* Offshore

for the depth numbers (figure 5). The width of each track is 2.5 inches. Depth lines are printed horizontally across the curve tracks (Schlumberger, 1974).

Three types of grids are available, track 1 (far left of log) has a linear grid, (A.P.I. standard) of 1/4 inch per division to the right of track 1 is the depth scale. On the united States depth scales used are 1, 2, or 5 inches per 100 feet of hole. Immediately to the right of the depth scale are tracks 2 and 3. Tracks 2 and 3 can have logarithnic and or linear grids or a combination of logarithmic in track 2 and linear in track 3 (Schlumber, 1974).

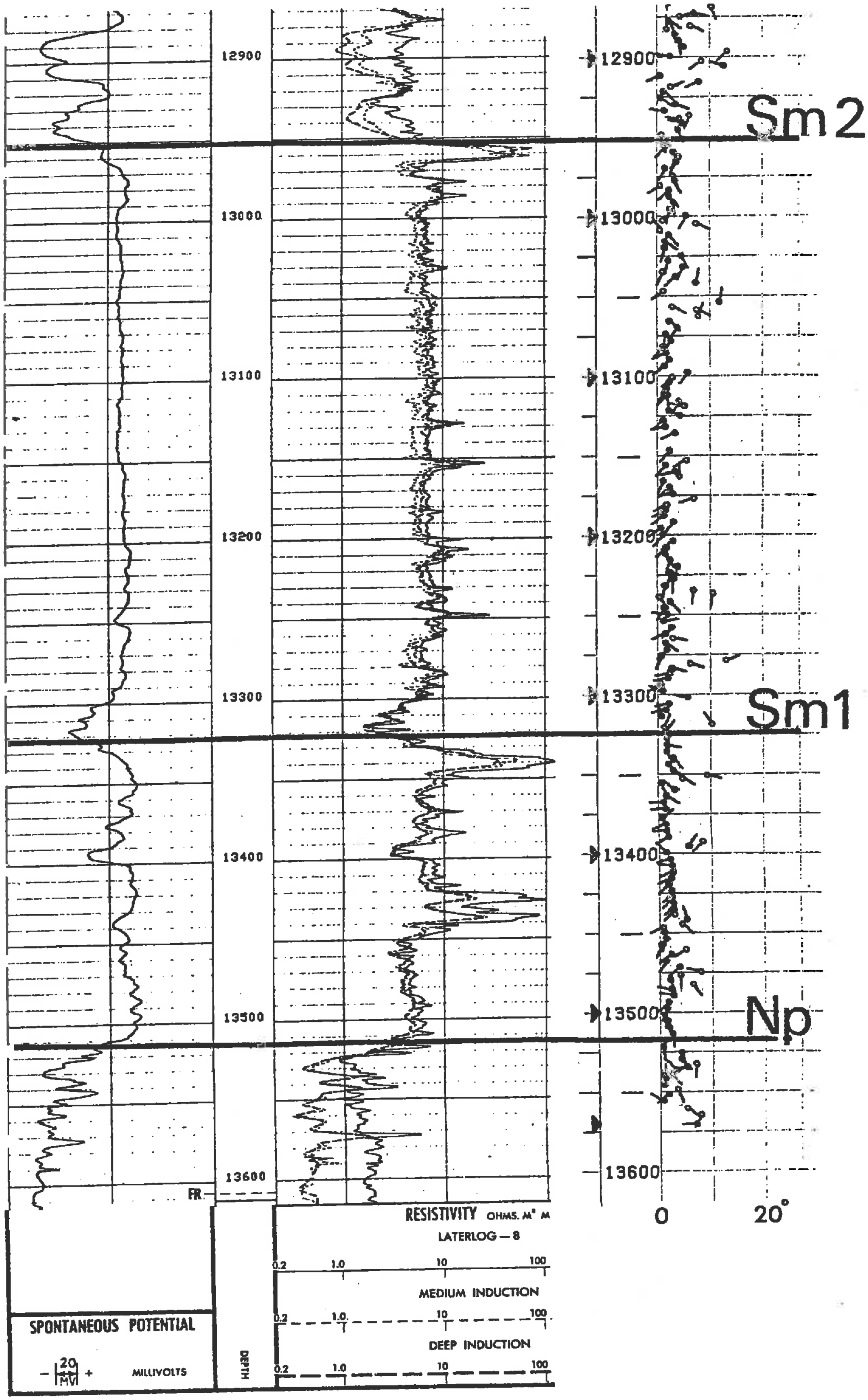
<u>Correlation of logs</u>.

Correlation of formations and parastratigraphic (Krumbein and Sloss, 1963) units was performed with the use of the self-potential (S.P.) and resistivity records displayed in electrical and/or induction logs. Depths to formations were corrected for sub-sea elevation by substracting the reference elevation (elevation from which log is measured) from the depth read off of the geophysical log, in order to delineate the structural position of the unit.

"Electric logs have become a most effective geolo-

FIGURE 5

Geophysical well logs from Mesa Petroleum Corporation Permit 957 (reference well). Left track S.P. curve, track 2 and 3, resistivity curve. Far right continuous resolution (four arm) dipmeter. Note change in dip direction at Norphlet (Np) contact. Dipmeter north is up. Parastratigraphic units picked on electric log characters.


12900
13000
13100
13200
13300
13400
13500
13600
FR
Sm2
Sm1
Np
0
20°
RESISTIVITY OHMS. M² M
LATERLOG – 8
0.2 1.0 10 100
MEDIUM INDUCTION
0.2 1.0 10 100
DEEP INDUCTION
0.2 1.0 10 100
SPONTANEOUS POTENTIAL
– 20 MV +
MILLIVOLTS
DEPTH

gic tool; they are so widely understood by petroleum geologists and engineers that cross-sections and correlation charts are commonly prepared with only data from electric logs to indicate the stratigraphy and structure" (Levorsen, 1967 p. 78). I used the S.P. curve displayed in track 1 coupled with the resistivity curves displayed on tracks 2 and 3 for correlation purposes. The S.P. deflections may be either to the left (negative) or to the right (positive) depending mostly on the relative salinities of the formation fluids and of the mud filtrate (Schlumberger, 1974). Opposite the shales (or tight siltstones), the readings of the S.P. curve are usually fairly constant (Figure 5) and tend to follow a straight line on the log called the "shale base line." Shale deflections in salt water formations are positive or to the right of the log. The maximum negative deflection recorded over a given interval is considered the "sand base line." The correlation of electric logs involves the matching of plotted graphic records of two or more drilled holes, with a view to establishing the identity of the formations penetrated in these holes. An assumption of course is that the electric log recordings are in fact lithologic breaks.

Fault Interpretation

Nine datums, including the Lower Tuscaloosa, Sm 1 and Norphlet Formations, were picked and marked on the electric logs. The parastratigraphic units were assigned letter code names (table 3). The parastratigraphic units used in delineating faults between wells, were picked on the basis of a log characteristic. I first established a "normal" or reference section which could be used to compare with other wells in the embayment. An assumption made at this point was, that the thickest section would be in the middle of the embayment. The Mesa (957) well located near the center of the embayment filled this criteria.

For example, I correlated the electric logs from the Mesa (957) and Exxon (846) wells and found that the stratigraphic interval between the Lower Tuscaloosa and the Norphlet Formation as displayed by the electric log graphic record was almost identical. The stratigraphic interval between these two wells was only 4 meters (14 feet) of difference even though the wells are approximately 15.3 kilometer (9.5. miles) apart.

Using the established correlation markers (parastratigraphic units) found between the Mesa (957) and Exxon (846) well, I then correlated the Hunt (746) well with the Exxon (846) well. The first obvious difference noted was that the Norphlet Formation in the

TABLE 3

Structural elevations of Formations and datums used to delineate a fault between the (746) and (846) wells. Negative numbers are structural datum. LT - Lower Tuscoloosa; Sm 1 - lower member of Smackover Formation; NP - Norphlet Formation. Numbers under structure datum denote interval thickness. Numbers between wells is structural elevation difference between same datum in two wells.

*Datums "E" and "F" were not located in 957 well.

	746		846			957
DATUM						
LT	-4709	69	-4778	56		-4834
	735		713			718
A	-5444	47	-5491	61		-5552
	612		592			685
B	-6056	27	-6083	154		-6237
	1313		1299			1226
C	-7369	13	-7382	81		-7463
	2960		3164			3169
D	-10,329	217	-10,546	86		-10,632
	1665		1740			
E	-11,994	292	-12,286			*
	272		271	2726	2648	
F	-12,266	291	-12,557			*
	218		715			
Sml	-12,484	788	-13,272	8		-13,280
	161		156			190
Np	-12,645	783	-13,428	42		-13,470

Hunt well is considerably higher. Using this line of reasoning I compared other wells in the embayment and found a fault between the Mesa (960) and Exxon (814) well.

I have for purposes of this study only, used 76.2 meters (250 feet) as a minimum "missing" section, and as a possible indicator of a fault. That is I would correlate two logs both from the top and bottm of the log until I could not account for at least 76.2 meters (250 feet) in one log. This criteria has worked in this area and is not to be taken as an universal cut off point. Moore (1963; In Pirson, 1977) gave criteria for detecting subsurface faulting which include:

1. Dip of a marker bed abruptly changes on a cross section based on logs or on a contour map of a marker bed.
2. Omission of marker beds generally spells a normal fault.
3. Thickening of marker beds on the fault's downthrown side characterizes growth faults.

"By adequately correlating and identifying shale sections from logs as indicated above, the bed thickness (omitted or repeated) can be evaluated exactly and the vertical throw distance may be calculated" (Pirson, 1977 p. 198).

Sample Description

Approximately 2,900 meters (9,500 feet) of section were described for this study. Samples from eleven wells were petrographically studied using a binocular microscope. Folk's (1959, 1962) and Dunham's (1962) classification schemes were used for the carbonate rocks. The clastic rocks were named according to Pettijohn's (1957) outline of sedimentary rock classification. Textural parameters noted included grain size, sorting, packing, fabric and shape. Porosity classification of the carbonate rocks is slightly modified from Choquette and Pray (1970). Vuggular or microvuggular porosity is that in which the pore throat is almost equidimensional differentiated from channel porosity in which the pore throat has at least one elongated axis when observed in thin-section. Fracture porosity is that in which the pore space is at least 10 times longer along any one axis. Moldic porosity is that in which the host grain can be identified. For example a well rounded pore throat with a recognizable ooid origin would be classified as oomoldic porosity.

Sample intervals ranged from 1.5 meters (5 feet) to 3 meters (10 feet) except for cored intervals, where 1 meters (3 foot) samples were available. In addition, eighty thin-sections from cores taken in two wells were made and described in order to aid in the interpretation of the paleoenvironment of the Smackover Formation. All well lithologic descriptions are in appendix.

Samples were depth corrected by plotting the sample lithology on a five inches equal one hundred feet sonic log (figure 6). Using these strips. lithologic cross-sections (in pocket) were constructed and then reduced to a working size. The samples were plotted on the sonic log so that their stratigraphic position could be ascertained.

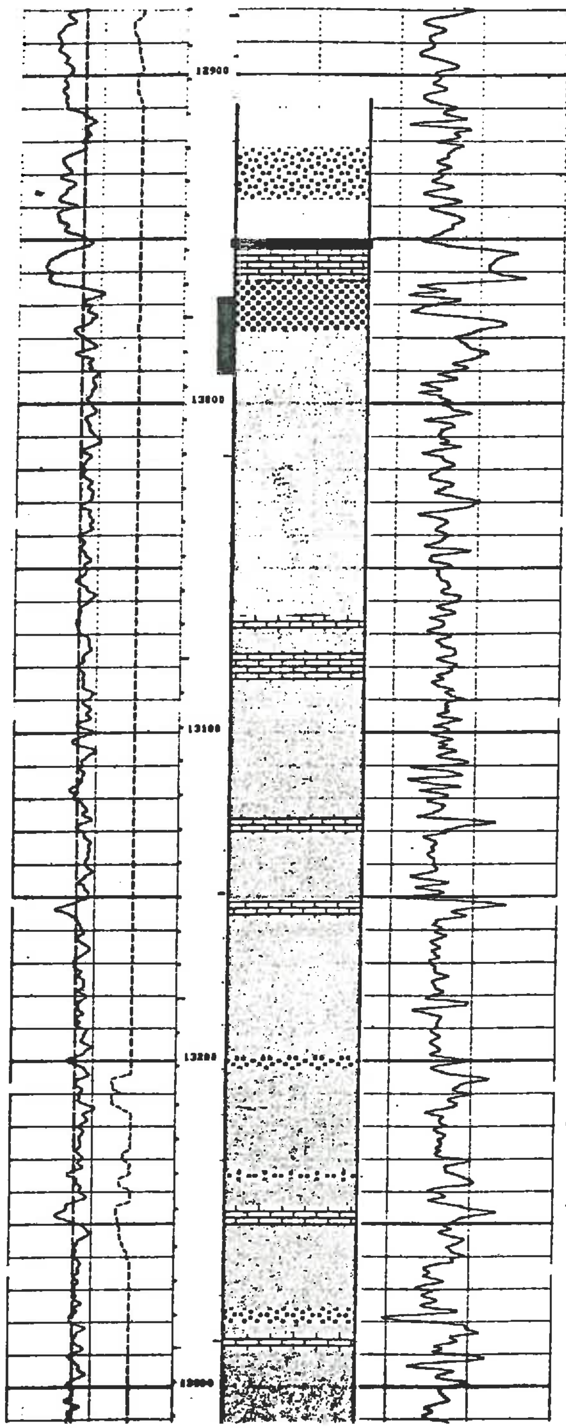
"Lithostratigraphic-Level" maps

The "litholostratigraphic-level" maps constructed for this study are a result of a modified technique after Deaver (1979). Deaver constructed lithologic cross-sections and then sliced the cross-sections at 25% intervals. From this data he then constructed what he called "slice maps." I believe this method to be biased because similar lithologic units are automatically correlated from well to well in a stratigraphic cross-section. My technique involves "slicing" each member of the Smackover (Sm 1 and Sm 2) at ten percent intervals ($\pm$ 2%) and noting the lithology at the slice

FIGURE 6

Reference Well Sonic Log and Sample lithology log. The reader is directed to the appendix for a detailed lithologic description.

REFERENCE WELL
MESA Petroleum Company 29-4
St. Joe Paper Company, Gulf County
Permit 957



Top Smackover (Sm 2)

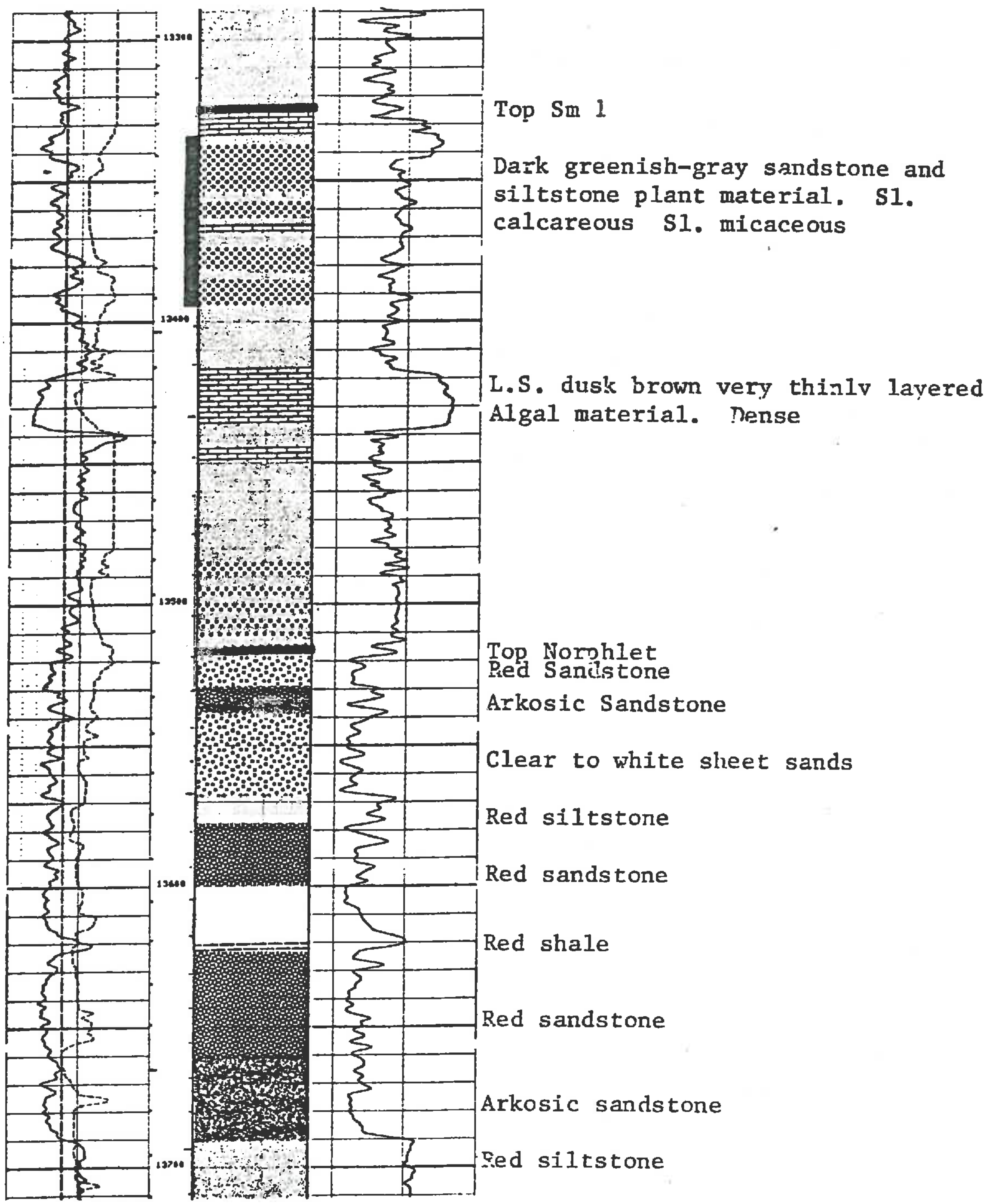
Gray siltstone-fine grain sandstone. Thinly bedded dissiminated plant material.

L.S. micritic, mod. ind.

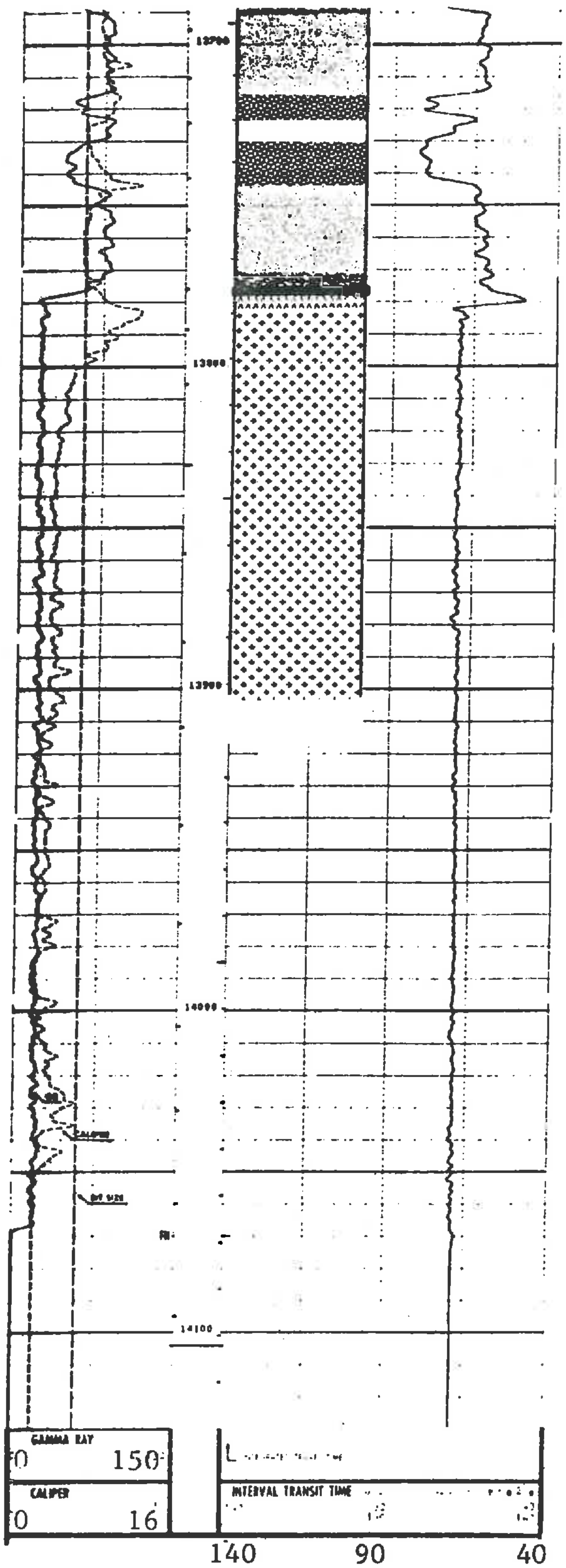
Gray siltstone

Siltstone dark gray

L.S. oolitic(?), micritic 10-15% Por.


Top Sm 1
Dark greenish-gray sandstone and siltstone plant material. Sl. calcareous Sl. micaceous
L.S. dusk brown very thinlv layered Algal material. Dense
Top Norphlet
Red Sandstone
Arkosic Sandstone
Clear to white sheet sands
Red siltstone
Red sandstone
Red shale
Red sandstone
Arkosic sandstone
Red siltstone

P-(957)



Top Louann Salt

Salt based on Sonic Interval transit time point. The lithologies were then contoured with an isolith isopleth. The advantage of this method is that no previous correlation (i.e. stratigraphic cross-section) of lithologies is assumed in the construction of the maps.

RESULTS (DATA)

STRATIGRAPHY OF THE APALACHICOLA EMBAYMENT

Basement

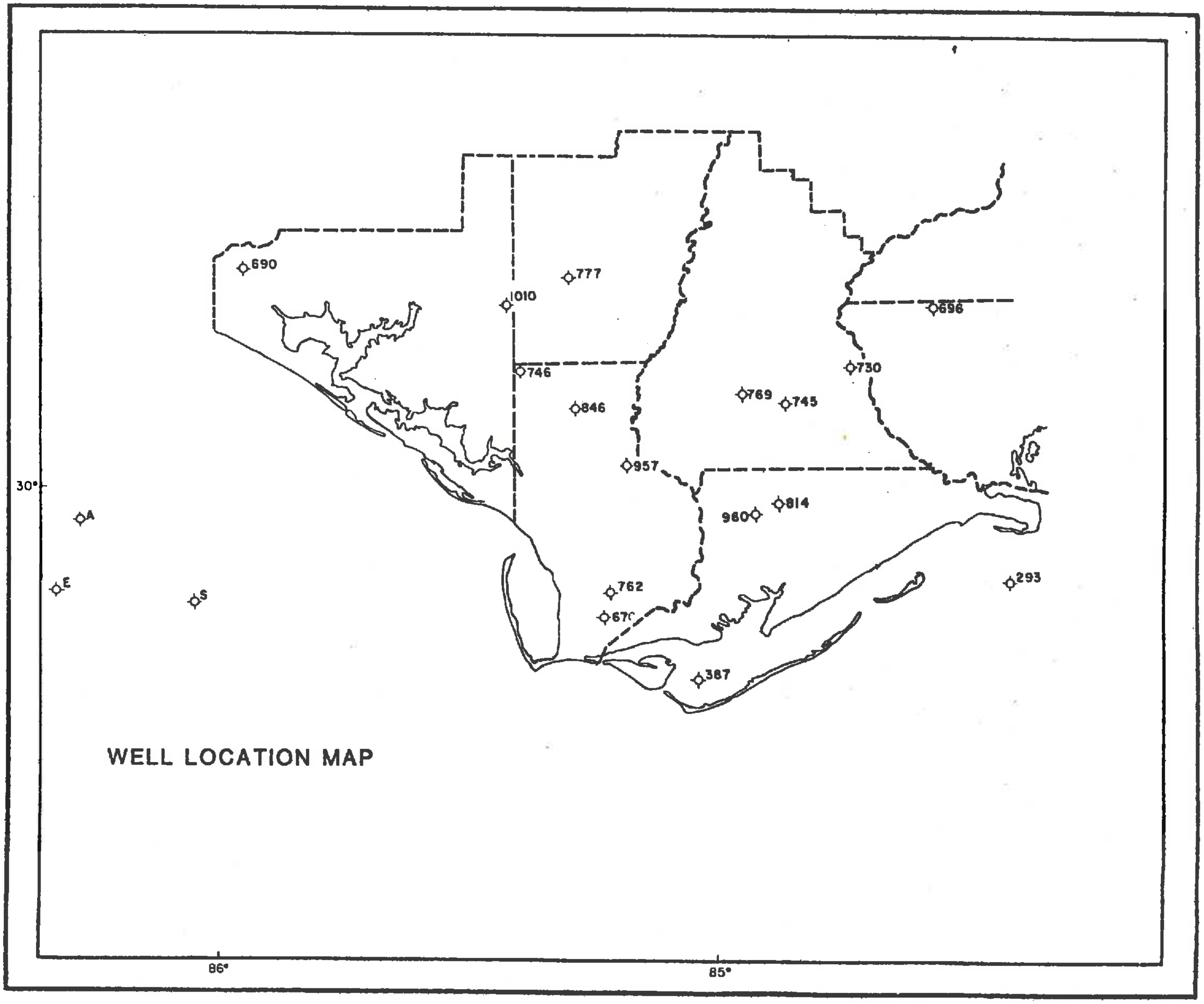
Basement rock was only encountered in three wells. In the Placid Oil Company (745) well (figure 7) 39 meters (127 feet) of granite were penetrated before abandoning the well. The granite encountered in this well is fine to medium grained, with abundant potash-feldspar. Chlorite and biotite mica causes the rock to appear slightly mafic.

The Hunt Oil Company (746) well penetrated 118 meters (387 feet) of coarse grained granite. This rock is orange to white in color due to the abundance of potash-feldspar. Less than 1 to 2 percent accessory minerals were noted in the samples.

A feldspar concentrate sample from this granite was radiometrically dated by Geochron Laboratory using the K/Ar method. It yielded an age of 709$\pm$ 25 million

FIGURE 7

Well location map, three wells Amoco(A), Exxon (E) and Sunoco(S) offshore Florida in Destin Dome Area. Other well number refer to Florida Department of Natural Resource permit number.


690
1010
777
746
846
957
769
745
730
696
960
814
762
670
387
293
A
E
S
30°
86°
85°
WELL LOCATION MAP

years. (Table 4 in Appendix)

The Houston Oil and Minerals (1010) well drilled through 203 meters (66 feet) of granite which appears to be the same granite body drilled in the Hunt Oil Company (746) well. Similar granite occurences have been observed by the author in the Charter Oil Exploration (690) well in Bay County and further west in another deep oil test in Walton County.

Other igneous rocks encountered in the Apalachicola Embayment area but not considered basement by the author include a rhyolite porphyry in the Charter Exploration Company (670) well. Thirteen meters (42 feet) of this unit were drilled before the well was abandoned. This rock has a very light reddish-brown groundmass with quartz phenocrysts some of which contain fluid inclusions.

Eagle Mills Formation

The Eagle Mills Formation was encountered in three of the wells in the embayment and in some of the up-dip wells. This unit is composed of red to brown, very fine grained sandstones and siltstones. These units contain varying amounts of very fine, disseminated, clear mica flakes and quarts. Minor amounts of limestones are occasionally encountered. Clear to translucent, coarse to medium grain sheet-sands are also present.

The Mobil Oil Corporation (387) well was drilled through 158 meters (520 feet) of Eagle Mills before total depth was achieved. Compensated Neutron-Formation Density log evaluation of this well indicate a number of dikes and/or sills were encountered in this section. Barnett (1975), reported an age of 180-200 million years for the diabase encountered in this well.

Other wells in the embayment encountering the Eagle Mills were the Placid Oil Company (745) well, which drilled through 52 meters (171 feet), and the Hunt Oil Company (746) well, which has a 10 meter (33 feet) section.

Louann Salt

Louann Salt was encountered in four wells in the onshore portion of the Apalachicola Embayment. In addition, the Placid Oil Company (696) well, in Wakulla County, encountered 215 meters (705 feet) before reaching the Eagle Mills. Even though no sample were recovered from this interval, the Borehole Compensated Sonic log indicate a very homogeneous "clean" salt. Offshore in the Destin Dome area the Sun Oil Company well, encountered the Louann Salt at -5320 meters (-17454 feet).

In the Embayment area the Mesa Petroleum Company (957) well encountered the Louann Salt at -4185 meters (-13729 feet). This well was drilled through 125 meters (409 feet) of salt before it was abandoned. Sonic log evaluation of this interval indicated a very "clean" salt with an average interval transit time of 69 to 71 microseconds per foot. The upper 1.5 meters (4 feet) of this units appear to be an anhydrite cap based on a sonic interval transit time of 49 microseconds per foot. Gramma ray readings in this interval is around 5 A.P.I. units (American Petroleum Institute standard).

The Placid Oil Company (769) well had 38 meters

(125 feet) of section drilled. The samples are composed of very fine grained white anhydrite, and in the absence of a sonic or density log for this interval, the whole section is assumed to be an anhydrite.

The Placid Oil Company (745) well has an 18 meter (58 feet) section of anhydrite. Formation Density log evaluation of this interval yields an average of 2.92 to 2.96 gm/cc density.

The Hunt Oil Company (746) well has 2 meters (6 feet) of anhydrite. Even though no anhydrite was recovered from this interval, the sonic log suggests its presence with an interval transit time of 58 microseconds per foot and low gamma-ray activity. The 53 microseconds per foot is slightly higher than that report by Hilchie 1976 (page G-71) of 50 microseconds per foot for anhydrite. This can possibly be due to impurities in the anhydrite and/or salt which has a higher 67 microseconds per foot interval transit time.

Norphlet Formation

The Norphlet Formation is composed of Arkosic sandstones and conglomerates, red and grey siltstones, shale and clear to translucent medium to coarse grained sheet-sands.

Five wells have penetrated the entire Norphlet interval. The thickness of the Norphlet in these five wells varies from 23 meters (75 feet) in the Placid Oil Co. (745) well, on the northern flank of the embayment, to 79 meters (259 feet) in the Mesa Petroleum Co. (957) well, drilled approximately in the center of the embayment.

Arkosic sandstone makes up most of the Norphlet in the southern part of the embayment. The Charter Oil Co. (762) well, drilled 19 meters (63 feet) into the Norphlet, which was all composed of Arkosic sandstone. The Mobil Oil Corporation (387) well, penetrated 33 meters (107 feet) of Norphlet, most of which was arkosic sandstones and minor amounts of clear to translucent medium to coarse grained sheet-sands.

The Hunt Oil Co. (746) well, has 40 meters (132 feet) of Norphlet. The upper part of the Norphlet in this well is an arkosic sandstone.

The Placid Oil Co. (769) well, has a 63 meter (206 feet) Norphlet section. The lower part of this well is composed of arkosic sandstone while the upper half of the Norphlet is composed of sheet-sands. The Mesa Petroleum (957) well, has the thickest Norphlet section drilled to date in the embayment. Seventy-nine meters (259 feet) of Norphlet were drilled in this well. The section is composed, for the most part, of red siltstone and sandstone units, with some arkosic sandstone beds in the middle and lower part of the section. The upper part of the Norphlet in this well is made up of sheet-sands.

Of the nine wells which penetrated the Norphlet Formation in the embayment, two wells, the Mesa Petroleum Co. (960) well, and the Exxon Oil Corp. (814) well did not encounter arkosic sandstones in this unit. Neither of these wells penetrated through the Norphlet.

The Exxon Oil Corp. (814) well, drilled 23 meters (75 feet) of red sandstone. A core taken from the top of the Norphlet appears to be cross-bedded, but the size of the sample prevents a definitive answer.

Smackover Formation

The Smackover Formation has been subdivided by the author into two parastratigraphic units. These units are based on electric log character (see figure 5). The differentiation of these units is explained in the methods section. The thickness of the Smackover Formation in the Apalachicola Embayment varies from 78 meters (257 feet) in the Hunt Oil Co. (746) well to 172 meters (565 feet) in the Mesa Petroleum Co. (957) well.

Sm 1

The lithology of Sm 1 varies from gray to olive green siltstones and shales, greenish gray to light brownish gray, very fine to medium grained well sorted sandstones and limestones. The lithofacies found in the limestones usually consist of mudstones, peloidal packstones and wackestones. The Exxon (846) well has 48 meters (156 feet) of Sm 1, 22 meters (72 feet) of which is limestone. The Mesa (957) well has 59 meters (190 feet) with 11 meters (36 feet), of limestone. On the east side the change is very abrupt. The Exxon

(814) well has 56 meters (185 feet) of Sm 1 all of which is limestone, while the Mesa (960) well which has 51 meters (168 feet) of Sm 1, only has 7 meters (22 feet) of limestone.

The Placid Oil Co. (769) well penetrated 68 meters (223 feet) of Sm 1, the thickest accumulation found so far in the embayment. Limestone makes up 31 meters (101 feet) of this unit, all of it in the upper part. The lower 37 meters (122 feet) is composed of siltstones and minor amounts of sandstones.

The limestones found in this well is composed of a lower 3 meters (10 feet) of light dusky yellowish brown peloidal wackestone or packstone (as described from well cuttings) and an upper 28 meters (91 feet) of calcsiltite, very thinly bedded with argillaceous layers. This unit grades upward into fine grained calcareous sandstones of the basal part of Sm 2.

The Placid Oil Company (745) well located east-southeast of the (769) well, has 45 meters (149 feet) of Sm 1. Of this 4 meters (14 feet) are limestones and the rest siltstone with minor amounts of sand-stones at the top of the unit. This limestone is very fine crystalline (sparite?) to micritic, hard and dense with some calcsiltite, probably interbedded with the micrite and siltstones, as evidenced by the fluctuations observed in the sonic and gamma logs.

The Mobil Oil (387) well drilled on the flanks of the rhyolite body, contained 48 meters (159 feet) of Sm 1. The lower 15 meters (50 feet) are limestone. Lithofaces of this unit vary from calcsiltite to micrite. The calcsiltite contains very fine argillaceous(?) layers and traces of pyrite. The calcsiltite appears to be interbedded with the denser dark brown to yellowish brown micrites. The top of Sm 1 in this well is marked by a 4 meter (14 feet) limestones unit which appears to be a micrite, but the size of the cuttings prevents a better definition of this lithofacies. The middle section of Sm 1 in this well is composed almost exclusively of light gray to olive-gray siltstone with intercaleted thin sandstone units.

Sm 2

The lithofacies found in Sm 2 are for the most part identical to those of Sm 1. The main difference being the lack of carbonates.

The thickness of Sm 2 varies from 40 meters (130 feet) in the Mobil Oil Co. (387) well in the southern end of the embayment, to 119 meters (342 feet) in the Exxon (846) well in northern Gulf County.

The Exxon Oil Co. (814) well, encountered 89 meters (293 feet) fo Sm 2. The lithology of Sm 2 in this well is marked by abundant beds of clear, medium to coarse grained sandstones. These beds interfinger with the gray to olive-gray siltstones and sandstones of Sm 2, and are much more abundant in the middle, and to a less extent the upper part of Sm 2.

The sequence observed above is not manifested in the Placid Oil Co. (745) well, due north of the Exxon (814) well. Instead, 93 meters (305 feet) of gray to olive-gray siltstone with occasional gray sandstone occurs in the upper part of Sm 2 in this well.

The Placid (769) well, located west-northwest of the Placid (745) well, drilled through 95 meters (312 feet) of Sm 2. The lithology of Sm 2 in this well is composed of calcareous gray sandstones and gray to olive-gray siltstones, with some limestone units in the lower and middle part of this well. The limestones vary from very fine grained dusky yellowish brown micrite(?), possibly dolomitic, to very thin bedded calcsiltite containing argillaceous seams.

The Exxon (846) well, in the center of the embayment drilled through 119 meters (329 feet) of Sm 2. Sm 2 is composed of gray-olive gray siltstone with numerous limestone beds throughout the section. The thickest accumulation of limestone in this well occurs in the upper part of the section. These limestones are composed of peloidal wackstones and packstones with occasional grainstones present. The uppermost part of Sm 2 in this well is marked by an oolitic limestone. This part of Sm 2 was not cored, so that no thin-sections of this oolitic unit were made.

The Mesa (957) well drilled near the Exxon (846) well (figure 38), has a 114 meter (375 feet) Sm 2 section. The lithology of Sm 2 in this well is dominated by the gray to olive-gray siltstones with minor amounts of limestone. The uppermost part of Sm 2 is also marked by an oolitic limestone. The oolites in this well appear to be replaced in part by an opaque mineral (pyrite ?). The matrix of this limestone has micro-vugular porosity and/or oomoldic porosity, with secondary pore enlargement.

In the southern part of the embayment, three wells penetrated Sm 2. The thickest accumulation is found in the Charter Oil (762) well, where a 102 meter (334 feet) section is present. The lithology in this well varies from gray sandstones to gray to olive-gray siltstones with minor amounts of limestones. The limestones in this well are found in the middle of the section.

The Charter Oil Co. (670) well has an 86 meter

(283 feet) of Sm 2 present. The lithology in this well is composed for the most part of gray-olive gray siltstone with minor amounts of gray sandstone and shale. Limestones in this well are found in the upper and middle part of Sm 2. These limestone units are dark brown to dusky yellowish brown micrites(?). No core was taken in this interval.

The Mobil Oil (387) well drilled through 40 meters (130 feet) of Sm 2. This unit is composed of interbedded gray to olive-gray siltstone and minor amounts of gray sandstone.

The Mesa Petroleum Co. (960) well, drilled through 73 meters (240 feet) of Sm 2. The lithology of Sm 2 in this well is composed of almost equal amounts of gray sandstones and gray to olive-gray siltstones, with minor amounts of limestone. The limestones in this well are for the most part very thinly bedded from 2 meters (6 feet) to 1 meter (3 feet).

P E T R O L O G Y

The lower Smackover Sm 1 unit in the Apalachicola embayment is characterized by the abundance of carbonates (approximately 50% of the section). A study of the carbonate facies of Sm 1 was conducted by studying thin-sections from two wells; the Exxon Corp. (814) and Hunt Oil Co. (746). The information acquired from this data will be used to interpret the paleoenvironmental conditions during Smackover "time".

Petrologic Summary: Exxon Co. U.S.A. permit (814)

The lithology of Sm 1 in the Exxon (814) well varies from mudstones to packstones (Dunham, 1962). The lower part of Sm 1 is dominated by mudstones (95%) and a few wackestone-packstone (5%) units. The upper part of Sm 1 is dominated by wackestone-packstone facies.

Peloids are the most common allochem (Folk, 1962) found throughout the section. The lower Sm 1 mudstone facies rarely exceeds 5% peloids, while the upper wackestone-packstone facies can contain as much as 40 to 50% peloids. These peloids range in size from .2 mm to .4 mm, and are oval to rectangular in shape. Most are highly micritized and contain no visible internal structure. It is possible that some of the peloids described above are foraminifera as suggested by the overall morphology of some of the grains (plates 1 and 2).

The next most abundant grains found are decapod(?) fecal pellets. These grains are rectangular (ranging in size from .3mm - .5mm x .6 mm - 1 mm) and oval (.3 mm x .4 mm). In addition, those that are better preserved have microspar striations running lengthwise (plate 3). Sigsby (1976), Bechler et al (1976), Moore et al (1981) and Moore (personal communication 1982) described these pellets as being very common throughout the Smackover trend.

The upper 12-15 meters (40-50 feet) of Sm 1 contain approximately 1-10% recognizable foraminifera (milliolids?). Other grains found are mollusk fragments, (gastropods and small thin-shelled pelecypods ?), ostracods, and echinoderm fragments. In the upper 10 meters (30 feet) superficial (grains with only 1-3 laminae) ooids (plate 2) are found in trace quantities. Algal covered grains were found throughout the section, and oncolithic-like structures (plates 4 and 5) are found in the uppermost 2-3 meters (6-10 feet).

The only recognizable algae found is Cf.

P L A T E 1

Peloidal wackestone-packstone. Note thin-shelled pelecypod, hinge line still visible. Irregular shape grains (intraclasts) and probably highly micritized forams (lower left). Hunt Oil Co. P-746 12634-635 feet x 40.

P L A T E 2

Foraminiferal wackestone. Note neomorphic microspar replacing micrite. Algal covered grain (upper right corner) completely replaced except for micrite envelope. Lower left corner, foraminifers (dark grains). Superficial oolite (center). Exxon Corp. P-814 11697-698 feet x 40.

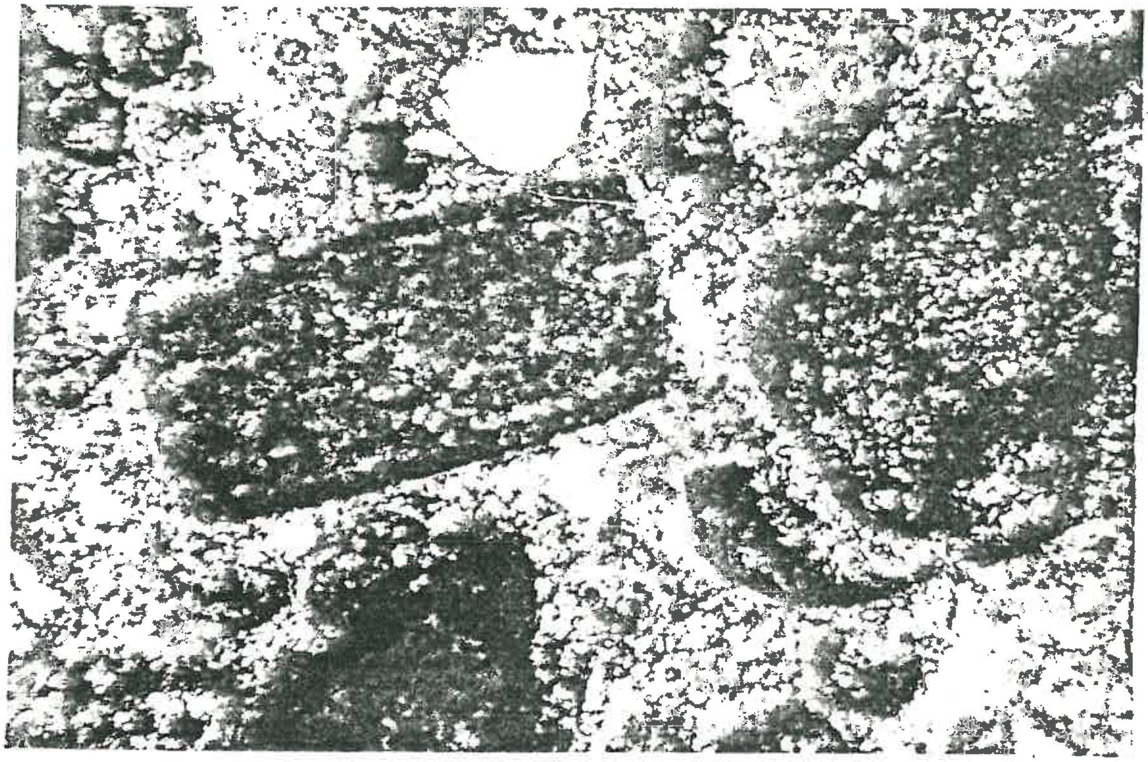
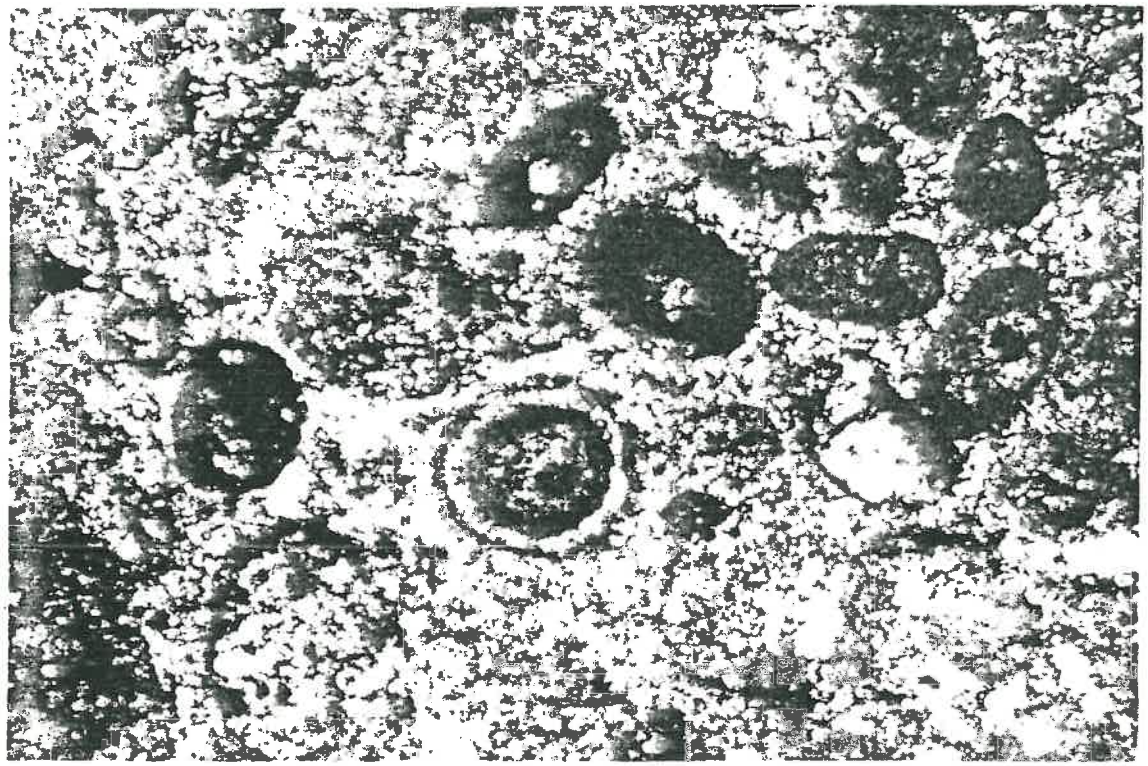


PLATE 3

Peloidal packstone-wackestone. Neomorphic replacement of micrite by microspar. Rectangular grain is a decapod(?) fecal pellet. Algal covered grain (oncolite?) (right and bottom left of plate). Exxon Corp. P-814 11697-698 feet.

PLATE 4

Decapod(?) fecal pellet (left side) (.4 x .6 mm). Algal covered pelecypod(?) fragment, and forams (?). Exxon Corp. P-814 11723-724 feet x 100.



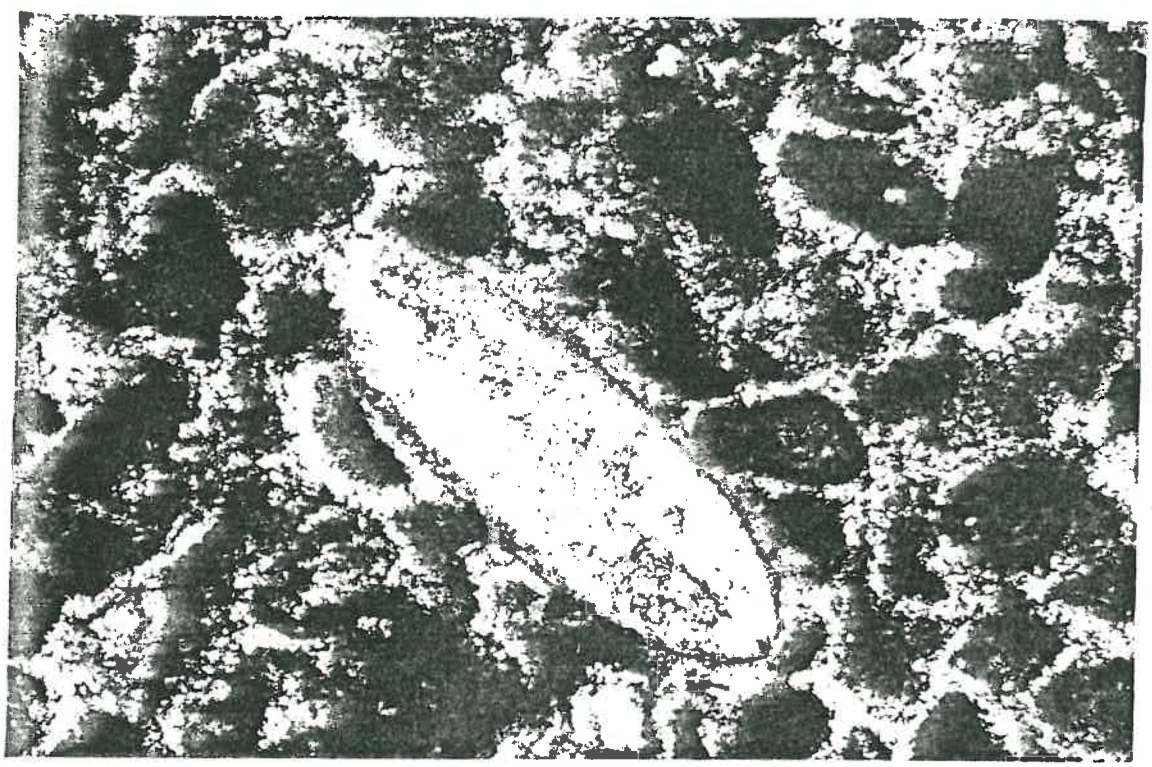


PLATE 5

Oncolite (.54 x .64 mm). Neomorphic microspar replacing micrite. Exxon Corp. P-814 11723-724 feet x 40.

PLATE 6

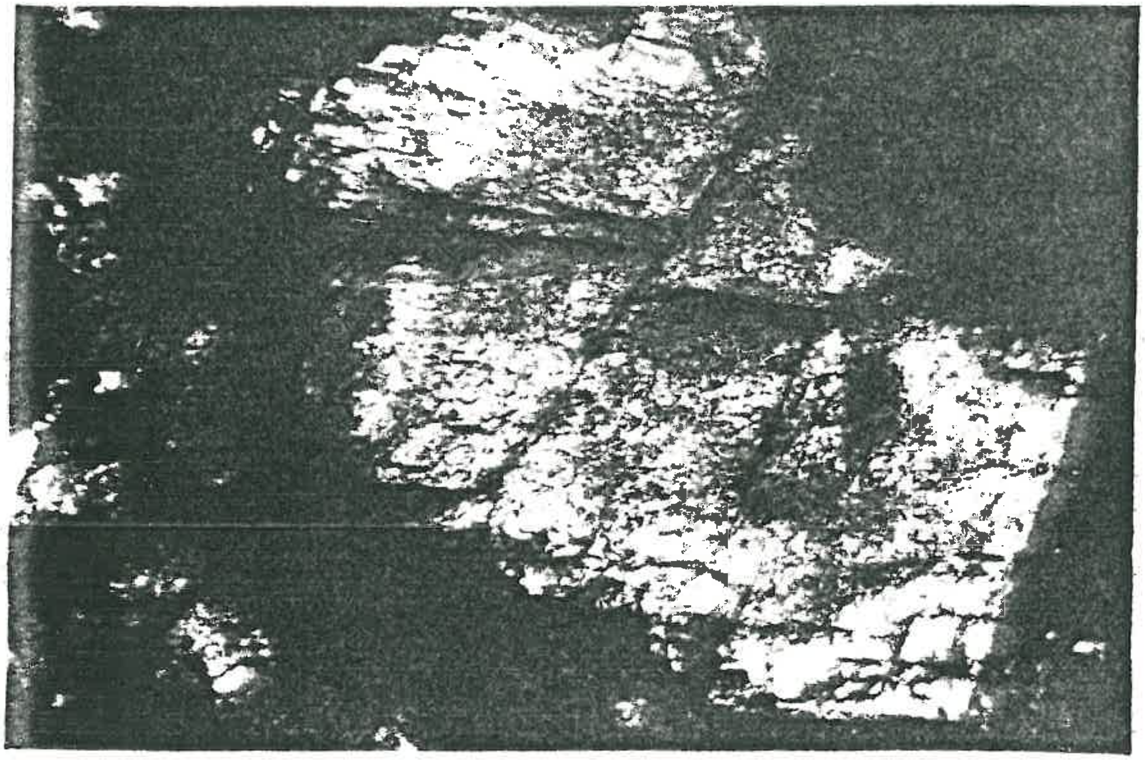
Cf. Girvanella sp. dark tubes. Neomorphic microspar replacing micrite. Exxon Corp. P-814 11708-709 uncrossed nicols x 40.

P L A T E 7

Peloidal packstone-wackestone. Large dolomite crystals plugging pore space. Exxon Corp. P-814 11770-771 feet.

P L A T E 8

Wackestone-mudstone. Note very small crystals growing along pore throat (large white feature). Peloids appear as cloudy dark (black) grain. Neomorphic microspar-spar replacement of micrite. Exxon Corp. P-814 11764-765 feet. Crossed nicols x 40.



Girvanella (plate 6), a green or blue-green algae (Ginsburg et al 1972) which is typically characterized by twisted filamentous tubes (Johnson, 1961). This algae was found scattered throughout the entire section.

Porosity varies, but is generally around 7-10%, with some units having as much as 15-20%. Most of the pore space found in this well is secondary, taking the form of channel, microvugular and some moldic porosity (Choquette and Pray, 1970). Dolomite crystals plugging as much as 20-30% of the pore space (plate 7) were found in middle and lower parts of Sm 1 in this well.

Neomorphic replacement of micrite(?) is found in most thin-sections. Plate 8 is an example of neomorphism. Note the micrite pockets still uncharged.

Petrologic Summary: Hunt Oil Co. permit (746)

The lithology of Sm 1 in the Hunt (746) well varies from mudstones to packstones. These facies appear to be roughly cyclic with no clear cut dominance of one facies over the other. Peloids are again the most common grain found. Peloid content is higher in the packstones of the Hunt (746) well than in those of the Exxon (814) well, comprising up to 70-80% of the grains present. Recognizable decapod(?) fecal pellets are the next most abundant grain, with quantities

P L A T E 9

Red encrusting(?) algae. Hunt Oil Co. P-746 12683-684 feet x 40.

P L A T E 1 0

Peloidal packstone-wackestone. Note healed fracture on large intraclasts. Note micrite envelope on intraclast. Neomorphic microspar after micrite. Exxon Corp. P-814 11697-698 x 40.

ranging up to approximately 10%.

Ostracods are fairly common, along with mullusk fragments, and scattered echinoid plate fragments. Oncolithic-like structures (plate 5) and/or algal bound grains (plate 4) are found near the top of the core (middle of Sm 1) and in one sample (12669-12670 feet) the grains constitute approximately 10-15% of the rock. The algae Cf. Girvanella was not encountered, but an unidentified red(?) encrusting algae (plate 9) was found in two thin-sections.

STRUCTURAL DATA APALACHICOLA EMBAYMENT

Geophysical well logs and lithologic descriptions were the main tools used to gather structural data. Table 5 is a list of formations and parastratigraphic datums used to construct all maps and cross-sections in this study. One exception is the Louann Salt Map, where a Bouguer Anomaly Map was used to define the possible updip limits of deposition.

Fault interpretation was based on electric log correlations. Table 3 (Methods Section) is a list of formations and parastratigraphic units used to help delineate faulting between two wells in the embayment.

T A B L E 5

Depth to Formations and Smackover Datums*

PERMIT	K.B.	BASEMENT OR IGNEOUS	EAGLE MILLS	LOUANN	NORPHLET	SMACKOVER Sm 1	Sm 2
387	38'		-13,811		-13,704	-13,545	-13,415
670	35'	-14,220				-14,188	-13,905
745	76'	-12,197	-12,026	-11,968	-11,893	-11,744	-11,439
746	81'	-12,816	-12,783	-12,777	-12,645	-12,484	-12,388
762	25'				-14,482	-14,277	-13,943
769	76'			-12,454	-12,248	-12,025	-11,713
814	51'				-11,824	-11,639	-11,346
846	60'				-13,427	-13,271	-12,879
957	48'			-13,729	-13,470	-13,280	-12,905
960	48'				-12,619	-12,451	-12,211

* All formation tops were depth corrected using Kelly Bushing elevation. Tops are correlated to geophysical well logs and are therefore marked off in feet. For C.G.S. units, please multiply datum by .3048 to obtain datum in meters.

DISCUSSION OF RESULTS

STRATIGRAPHY OF THE APALACHICOLA EMBAYMENT

The pre-Haynesville stratigraphy in the study area (Figure 8) is composed in ascending order of basement igneous rock, Eagle Mills Formation, Louann Salt, Norphlet Formation and the Smackover Formation. The Lower Haynesville Buckner member, a unit composed of red siltstones and sandstones interbedded with anhydrite and halite, was not encountered in the study area. The Haynesville Formation (not studied) is composed of red sandstones and siltstones, with occasional gray siltstones and shales. This unit also contains sheet-sands and thin limestone beds. Figure 9 is a map, showing location of stratigraphic cross-sections.

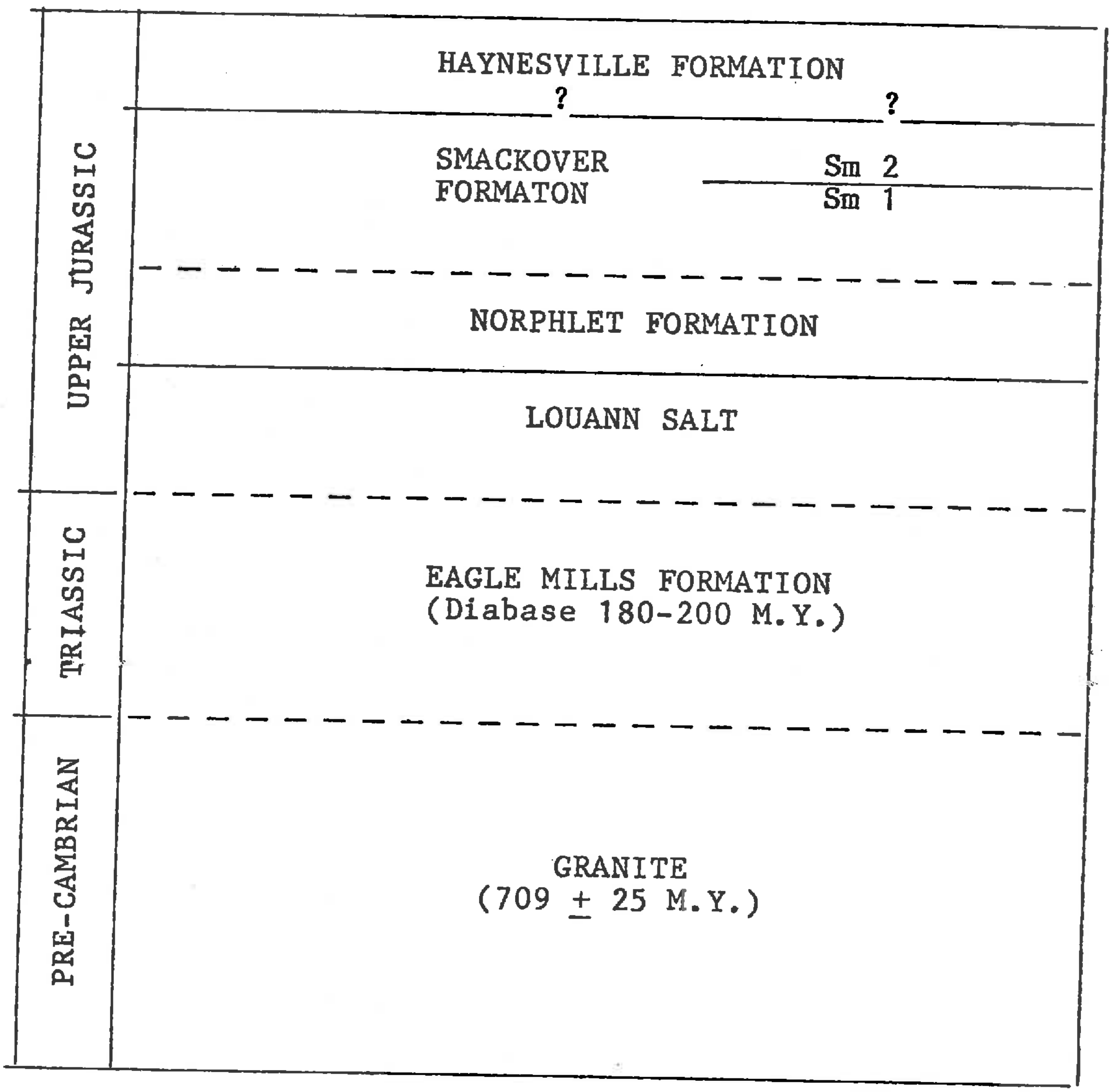
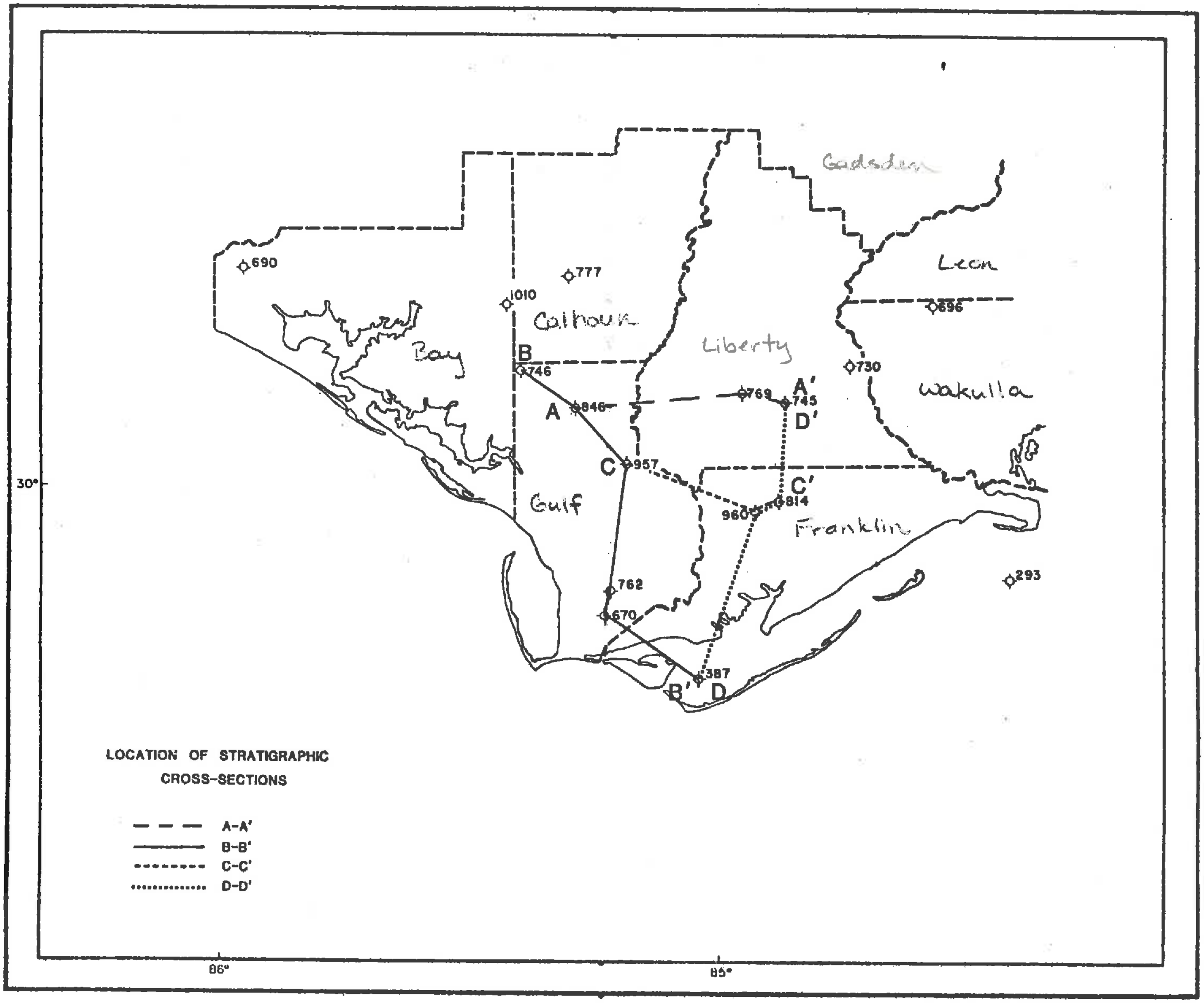


Figure 8: Stratigraphic nomenclature Apalachicola Embayment area Florida. Modified after Sigsby (1976) and Imlay (1980). Dashed line indicates unconformity.

FIGURE 9

Location of stratigraphic cross-sections. All cross-sections are found in the pocket.


Gadsden
Leon
Calhoun
Liberty
Wakulla
Bay
Gulf
Franklin
690
777
1010
696
730
B
746
A
846
769
A'
745
D'
C
957
C'
814
960
762
670
387
B'
D
293
30°
86°
85°
LOCATION OF STRATIGRAPHIC CROSS-SECTIONS
A-A'
B-B'
C-C'
D-D'

78
77

Basement

Basement rock was only encountered in three wells. The Placid Oil Company (745) well where 39 meters (127 feet) were penetrated before abandoning the well. The granite encountered in this well is fine to medium grained, with abundant potash-feldspar. Chlorite and biotite mica causes the rock to appear slightly mafic. This rock was described by Barnett (1975), as a granophyre. The author, however believes that it is a granite since it is not associated with any intrusion large enough to produce a differentiated granophyre, and it is closely associated with similar grantites in other wells. The Hunt Oil Company (746) well penetrated 118 meters (387 feet) of coarse grained granite. A feldspar concentrate sample from this granite was radiometrically dated by Geochron Laboratory using the K/Ar method. It yielded an age of 709$\pm$ 25 million years. (Table 4 in Appendix).

The Houston Oil and Minerals (1010) well (figure 7) drilled through 203 meters (666 feet) of granite which appears to be the same granite body drilled in the Hunt Oil Company (746) well. Similar granite occurrances have been observed by the author in the Charter Oil Exploration (690) well in Bay County and further west in another deep oil test in Walton

County.

Other igneous rocks encountered in the Apalachicola Embayment area but not considered basement by the author include a rhyolite porphyry in the Charter Exploration Company (670) well. Thirteen meters (42 feet) of this unit were drilled before the well was abandoned.

Eagle Mills Formation

The Eagle Mills Formation was encountered in three of the wells in the embayment and in some of the up-dip wells. The Mobil Oil Corporation (387) well (figure) was drilled through 158 meters (520 feet) of Eagle Mills before total depth was achieved. Compensated Neutron-Formation Density log evaluation of this well indicate a number of dikes and/or sills were encountered in this section. Barnett (1975), reported an age of 180-200 million years for the diabase encountered in this well.

Other wells in the embayment encountering the Eagle Mills were the Placid Oil Company (745) well, which drilled through 52 meters (171 feet), and the Hunt Oil Company (746) well, which has a 10 meter (33 feet) section. The Eagle Mills in the Hunt Oil Company (746) well was correlated on the basis of samples and geophysical log evaluation. This is based on an electric log "pick" of the overlying Louann Salt which appear to pinch out very near the vicinity of this well, since only 2 meters (6 feet) of Louann were found.

Cross-section A-A' (figure 10 in pocket) in the northern part of the study area suggest that the Eagle Mills Formation either has a very steep dip or has been faulted near the Placid (745) well. The thickest accumulation of this unit found so far in the Apalachicola Embayment is in the Mobil (387) well which penetrated 158 meters (520 feet), before the well was abandoned. This well appears to have been drilled, on an Eagle Mills paleo-high.

Louann Salt

Louann Salt was encounterd in four wells in the onshore portion of the Apalachicola Embayment. In addition, the placid Oil Company (696) well, in Wakulla County, encountered 215 meters (705 feet) before reaching the Eagle Mills.

Deposition of Louann Salt in the embayment was primarily controlled by a granitic paleo-high on the western side (figure 11) and probably by the two apparent paleo-highs indicated on the Bouguer Anomaly map (figure 12), as two positive value areas, on the southern side. A large negative Bouguer Anomaly (-36 milligals) approximately centered in western Calhoun County, suggest that the Louann Salt could be either thicker in this area or closer to the surface. However, no wells have been drilled deep enough to penetrate this interval in Calhoun County.

FIGURE 11

Area underlain by the Louann Salt. Southeastern boundary probably controlled by paleo-high areas. Northwestern boundary probably controlled by fault.

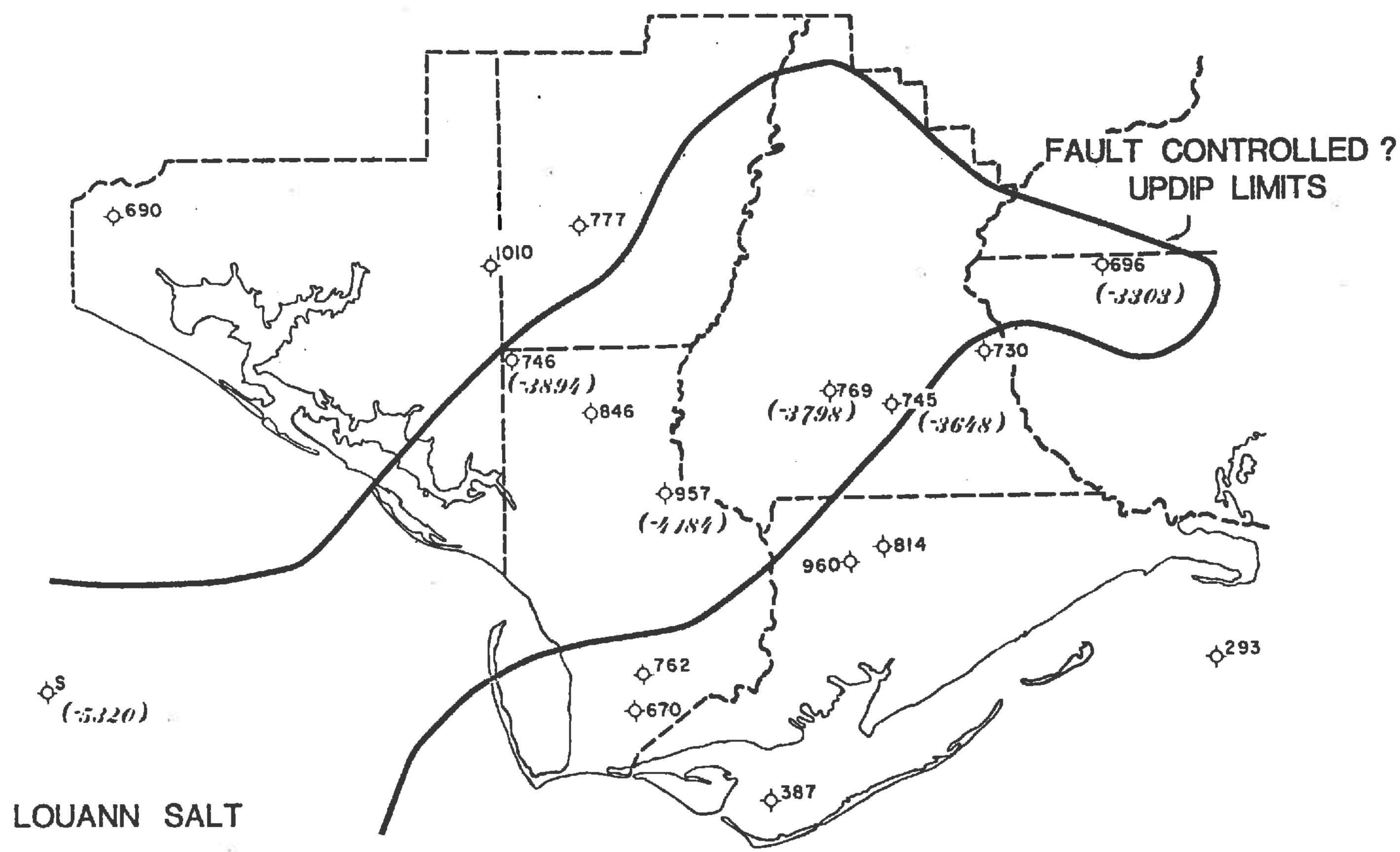
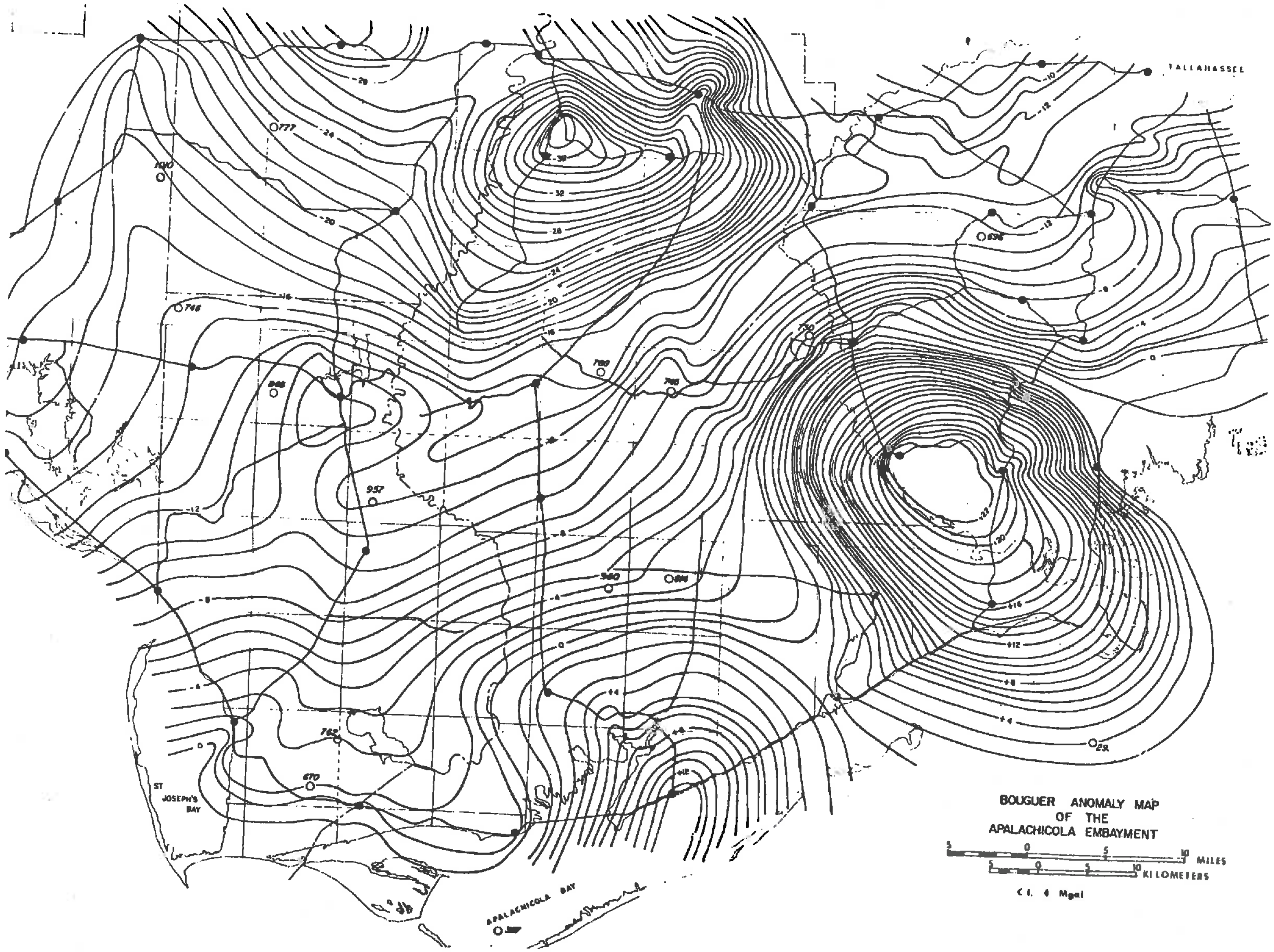

FAULT CONTROLLED ?
UPDIP LIMITS
690
1010
777
746
(-3894)
846
957
(-4184)
769
(-3798)
745
(-3648)
730
696
(-3303)
960
814
762
670
387
293
S
(-5320)
LOUANN SALT

FIGURE 12

Bouguer Anomaly map of the Apalachicola Embayment. Note two positive Bouguer anomalies in southern Franklin County, and negative Bouguer anomaly in Calhoun County. After Applegate, Pontigo and Rooke, 1978.



BOUGUER ANOMALY MAP
OF THE
APALACHICOLA EMBAYMENT

Norphlet Formation

Five wells have penetrated the entire Norphlet interval. The thickness of the Norphlet in these five wells varies from 23 meters (75 feet) in the Placid Oil Co. (745) well, on the northern flank of the embayment, to 79 meters (259 feet) in the Mesa Petroleum Co. (957) well, drilled approximately in the center of the embayment.

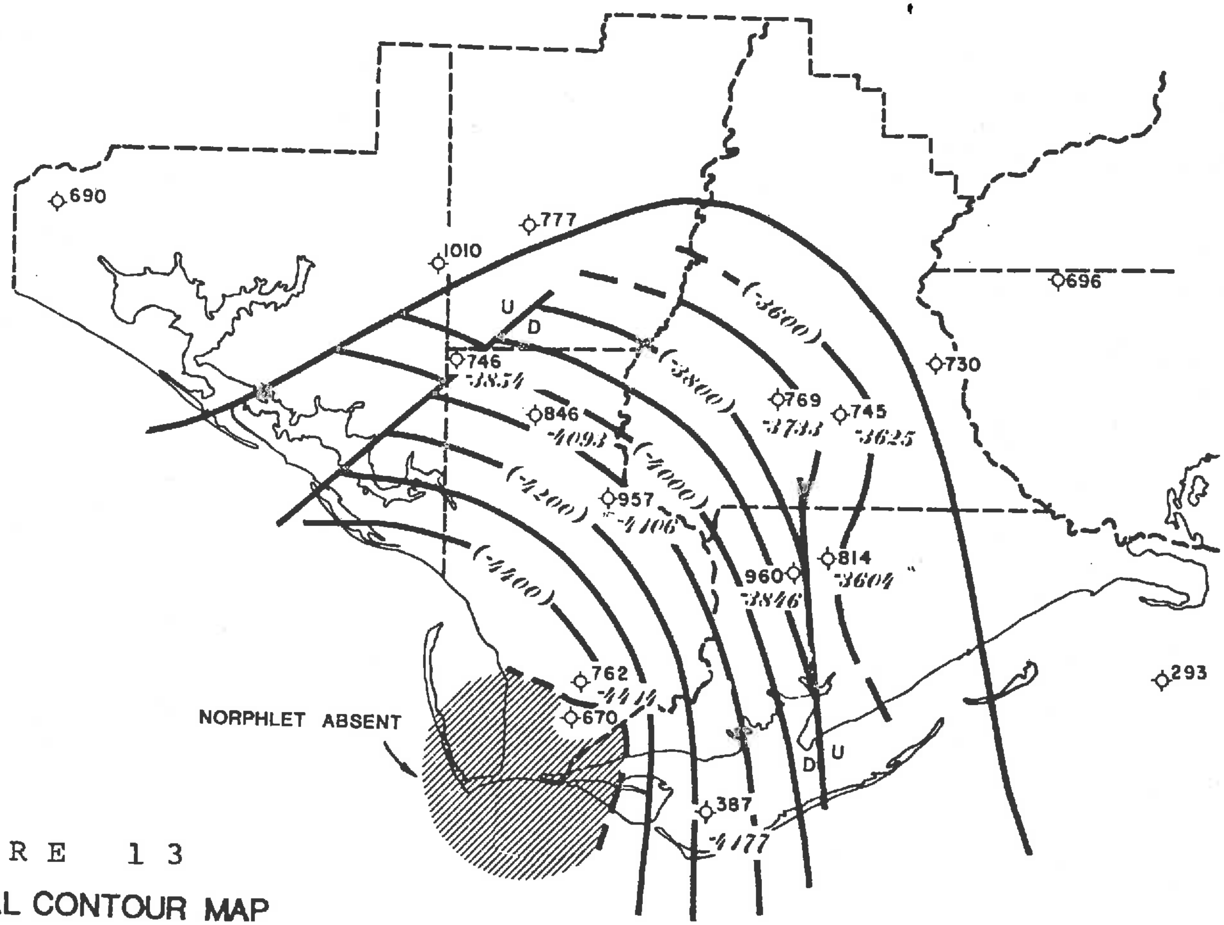
An isopachous study of the Norphlet, with limited well control, indicates a northeast-southwest oriented thick. Sigsby (1976) found that the Norphlet in the Jay trend area in extreme northwest Florida, has a similar trend. Sigsby felt that this orientation was due to the ancient Appalachian System which controlled the sediment type and deposition.

The Hunt Oil Co. (746) well, has 40 meters (132 feet) of Norphlet. The upper part of the Norphlet in this well is arkosic sandstone. The feldspar in these samples as well as all other feldspar found in the Norphlet in the embayment appears to be very fresh and would therefore indicate limited transport. The author feels that the source for the arkosic sandstones is the granite paleo-high near the Houston Oil and Minerals (1010) well and probably granite exposed in this general vicinity. The granite found in Hunt (746) and Houston (1010) wells is lithologically very similar to the arkosic sandstones found in the Norphlet.

The core taken from the Exxon (814) well, has a conglomeratic section at the top of the section probably indicating an erosional surface upon which the Smackover Formation was unconformably deposited. The Mobil Oil Corp. (387) well, penetrated 33 meters (107 feet) of Norphlet, most of which was arkosic sandstones and minor amounts of clear to translucent medium to coarse grained sheet-sands. The Norphlet in this well sits unconformably on red siltstones of the Eagle Mills Formation.

The Charter Oil Co. (670) well, did not encounter the Norphlet. Instead, there appears to have been a rhyolite paleo-high, which was exposed well into deposition of the overlaying Smackover (Sm 1) unit.

The axis of the embayment during Norphlet deposimap (figure 13) indicates a dip along the axis of the embayment of approximately 15 meters/kilometer (82 feet/mile).



F I G U R E 1 3

STRUCTURAL CONTOUR MAP
TOP OF NORPHLET FORMATION

C.I. 100 meters

Smackover Formation

The Smackover Formation has been subdivided by the author into a lower unit, Sm 1; and an upper unit, Sm 2. The subdivision of the Smackover is based on electric log character (see methods section) and therefore Sm 1 and Sm 2 are considered parastratigraphic units (Krumbein and Sloss 1963).

A series of "lithostratigraphic-level" maps were constructed in order to observe the distribution of sediment type in the Smackover, a technique modified from Deaver (1978) (See methods section for construction technique). As can be observed in these maps (figures 14 through 33), carbonate deposition appears to be controlled by the influx of clastics down the approximate center of the embayment. The two "fingers" of carbonate sediments appear to fluctuate towards the center of the basin, and is best seen in the western side of the embayment.

A study of the "lithostratigraphic-level": maps also reveal that the Smackover in the Apalachicola Embayment is a transgressive-regressive "wedge" of carbonates and clastics between the Norphlet Formation and the overlaying Haynesville Formation. This observation is based on the distribution of the carbonate facies, which appear to fluctuate in an approximate north-south

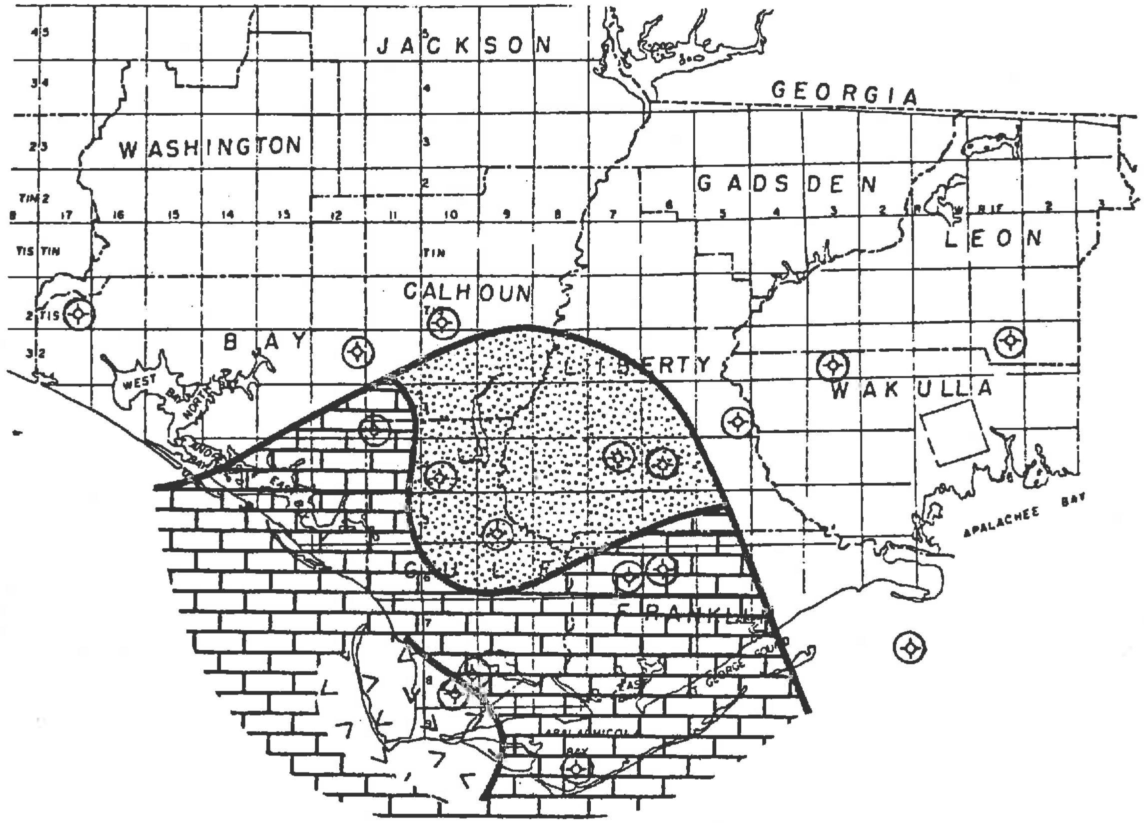
F I G U R E 14

10% "Lithostratigraphic Level" map of Sm 1 showing updip limits of the Smackover. Fine stipple pattern indicates gray to olive-gray siltstones and fine-grained sandstones with plant material inclusions. Scattered "V" pattern indicated rhyolite "paleo-high" found in Charter Oil Co. (670) well. Most of Bay County was probably a granite "paleo-high" during this time.

F I G U R E 15

20% "Lithostratigraphic Level" map of Sm 1 showing updip limits of the Smackover. Stipple pattern ind-dicates gray to olive-gray siltstones and fine-grained sandstones with plant material inclusions. Scattered "V" pattern indicated rhyolite "paleo-high" found in Charter Oil Co. (670) well.

92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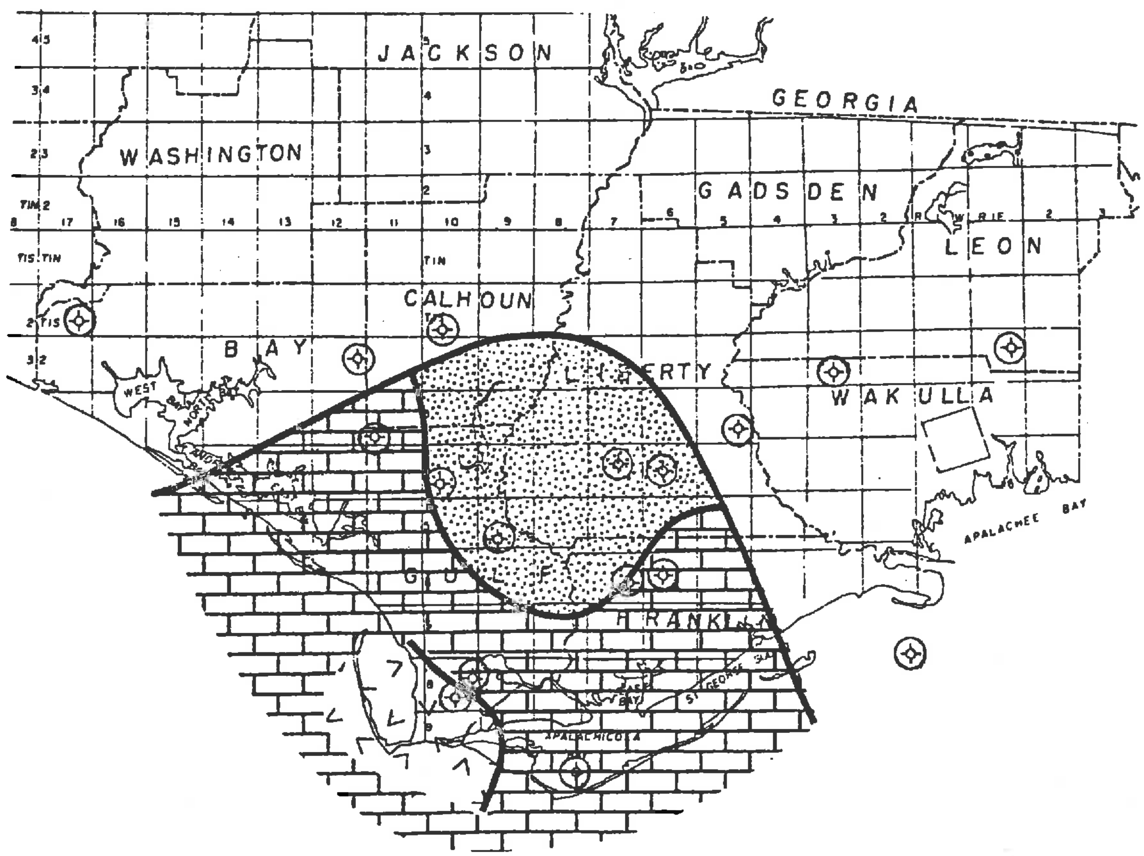
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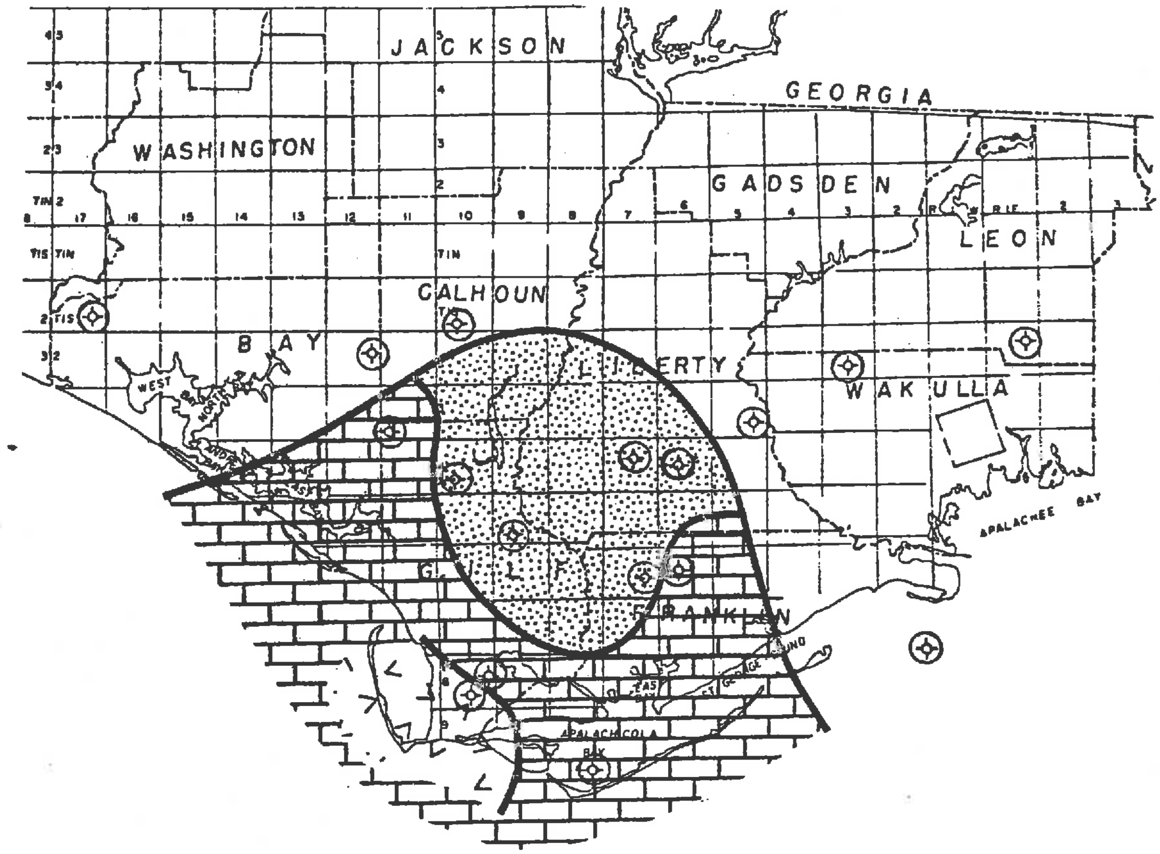
FIGURE 16

30% "Lithostratigraphic Level" map of Sm 1 showing updip limits of the Smackover. Note further shift of clastic "tongue" to the southeast of the embayment.

FIGURE 17

40% "Lithostratigraphic Level" map of Sm 1 showing updip limits of the Smackover. The Clastic "tongue" of sediments has now effectively separated western and eastern "carbonate buildup" areas.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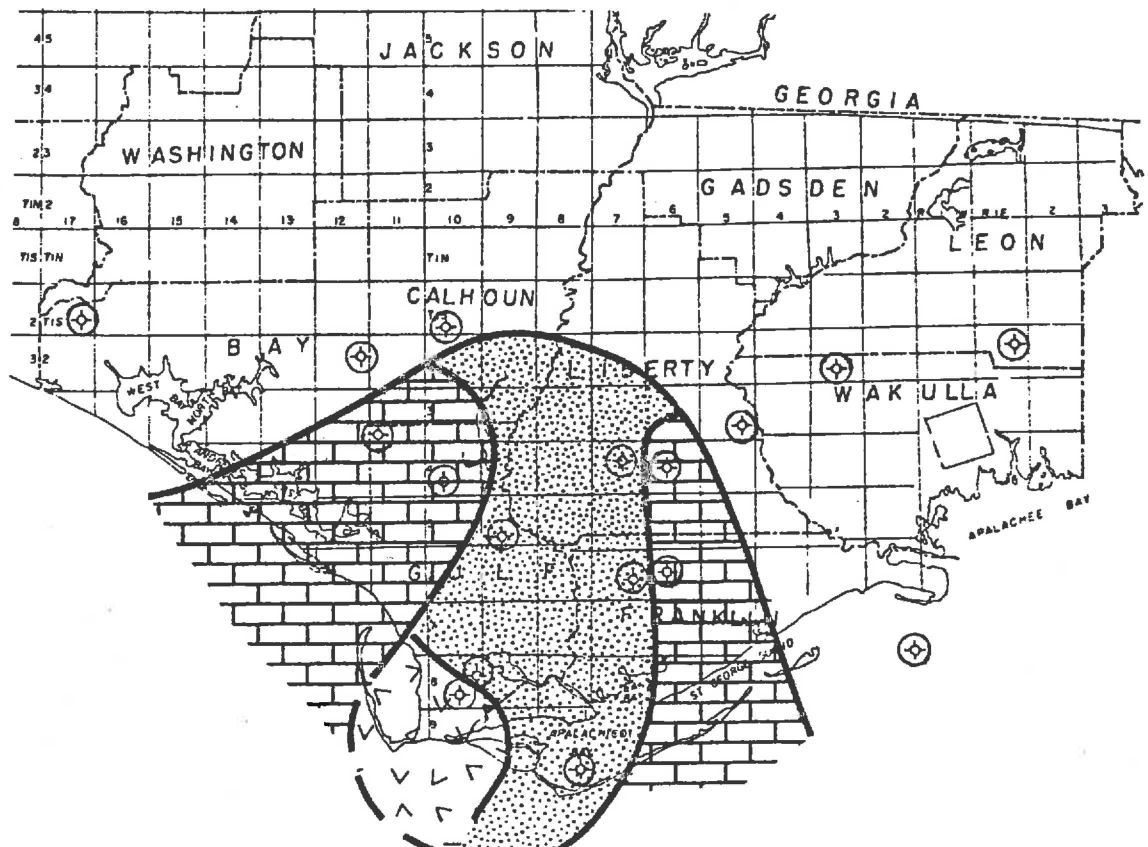
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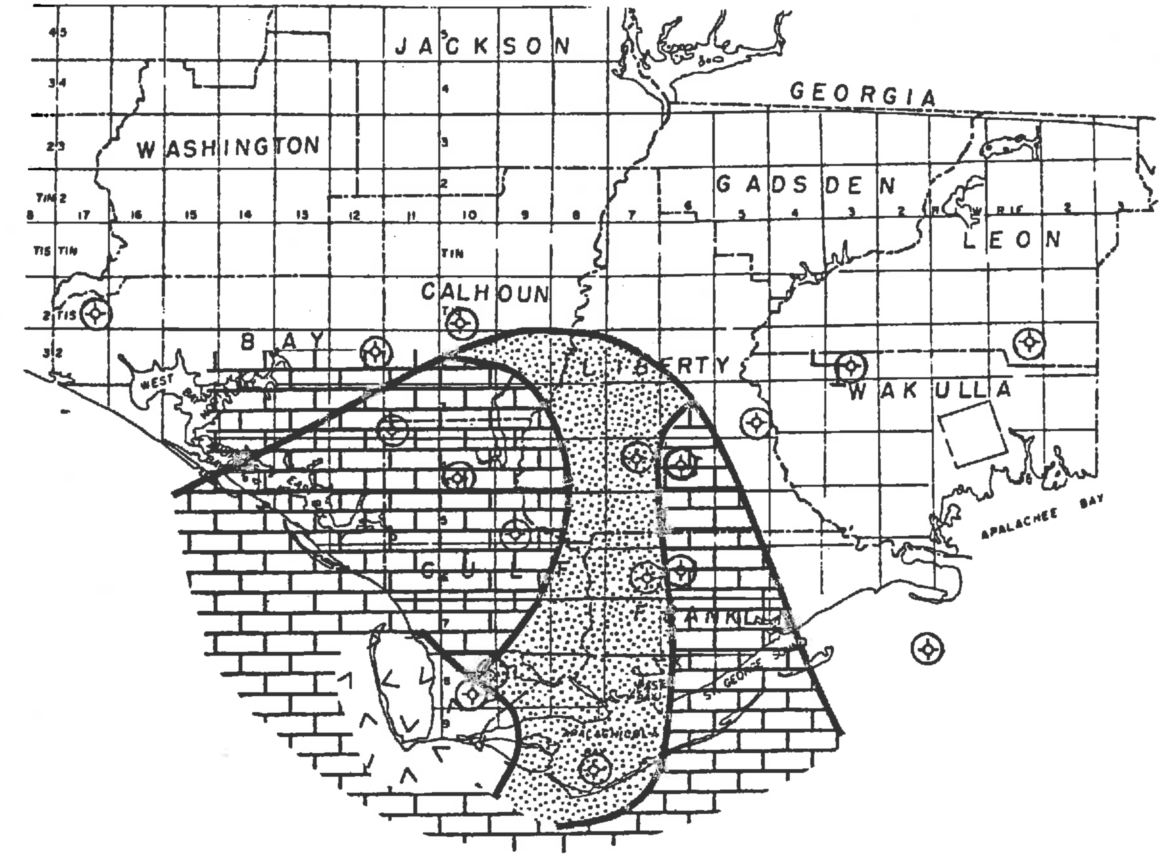
FIGURE 18

50% "Lithostratigraphic Level" map of Sm 1 showing updip limits of the Smackover. The western "carbonate buildup" area has now transgressed almost choking the clastic imput.

FIGURE 19

60% "Lithostratigraphic Level" map of Sm 1 showing updip limits of the Smackover. Minor regression noted by widening of clastic tongue around eastern edge of western "carbonate buildup."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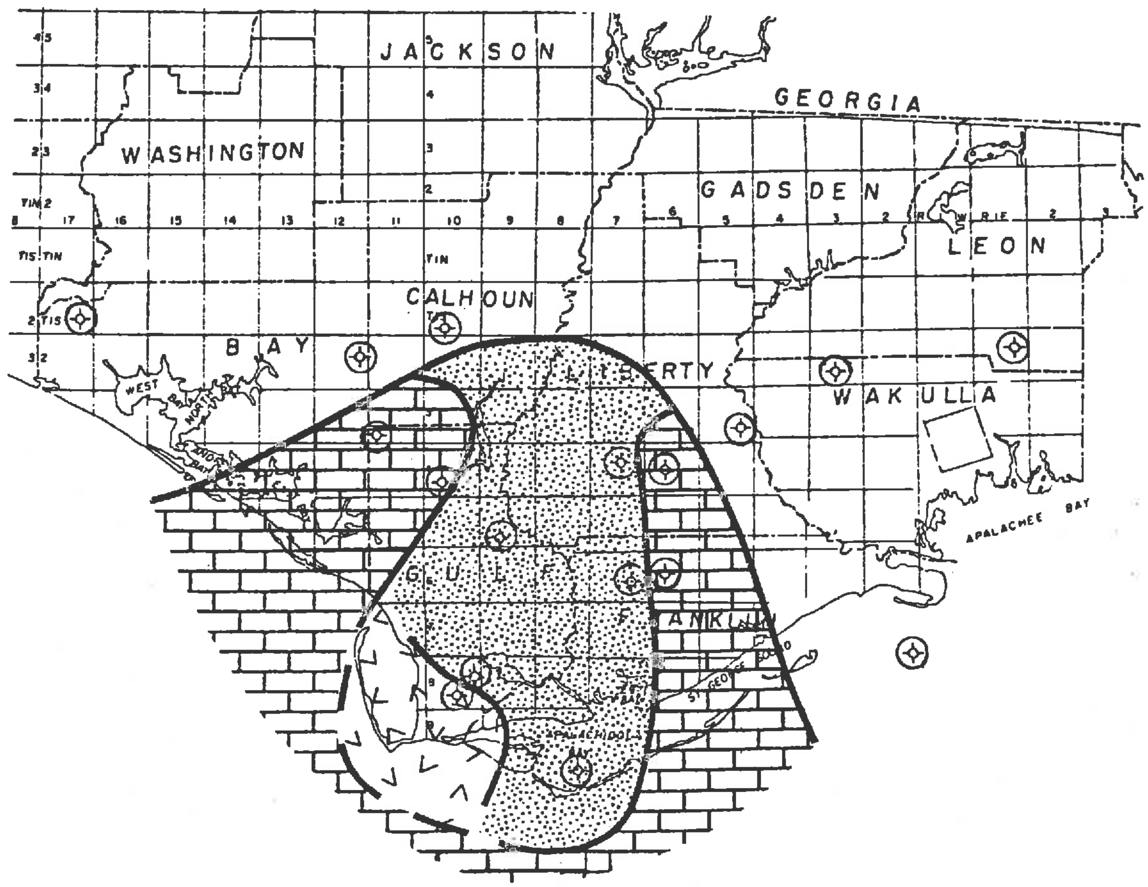
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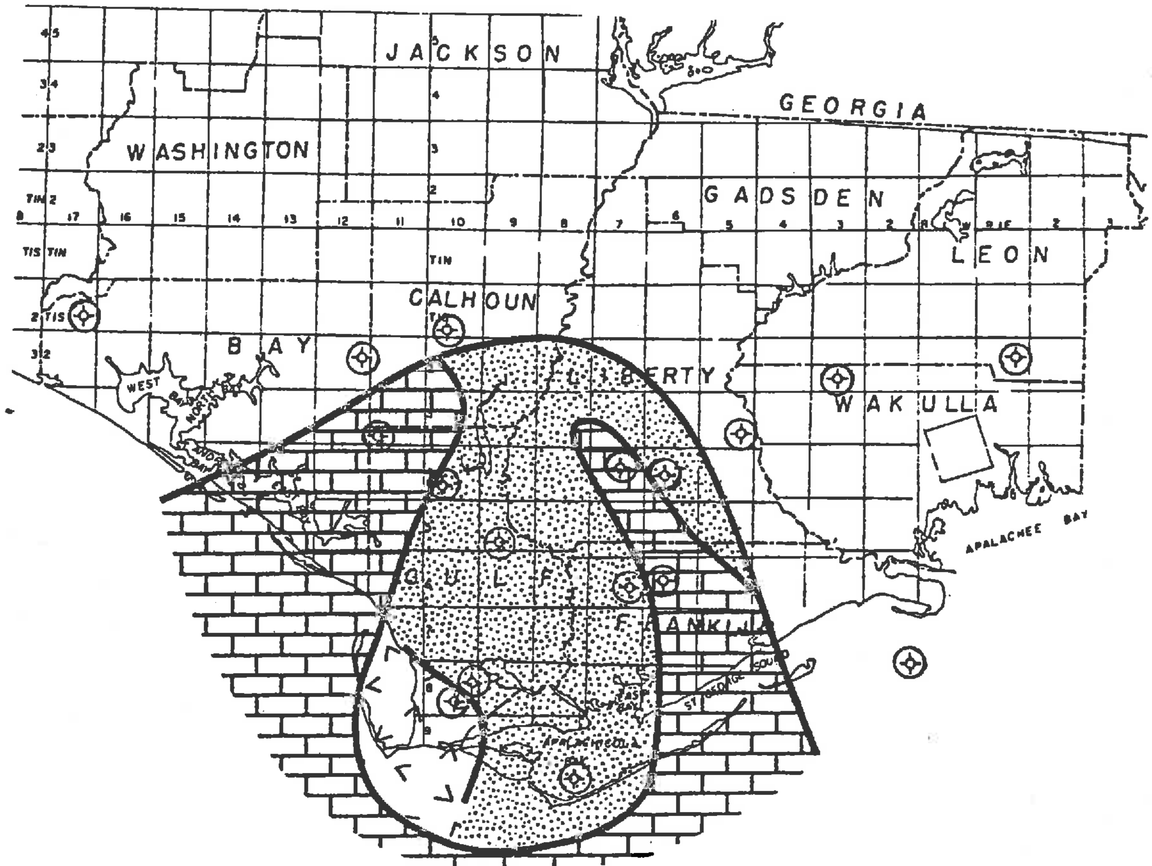
F I G U R E 20

70% "Lithostratigraphic Level" map of Sm 1 showing updip limits of the Smackove. Minor regression noted on 60% map has now shifted slightly to the west. Note eastern "carbonate buildup" has shifted to the west.

F I G U R E 21

80% "Lithostratigraphic Level" map of Sm 1 showing updip limits of the Smackover. The rhyolite "Paleo-high" has by this "time" been covered by limestone. Start of major transgression is noted at this level. Note the advance of the western "carbonate buildup" area.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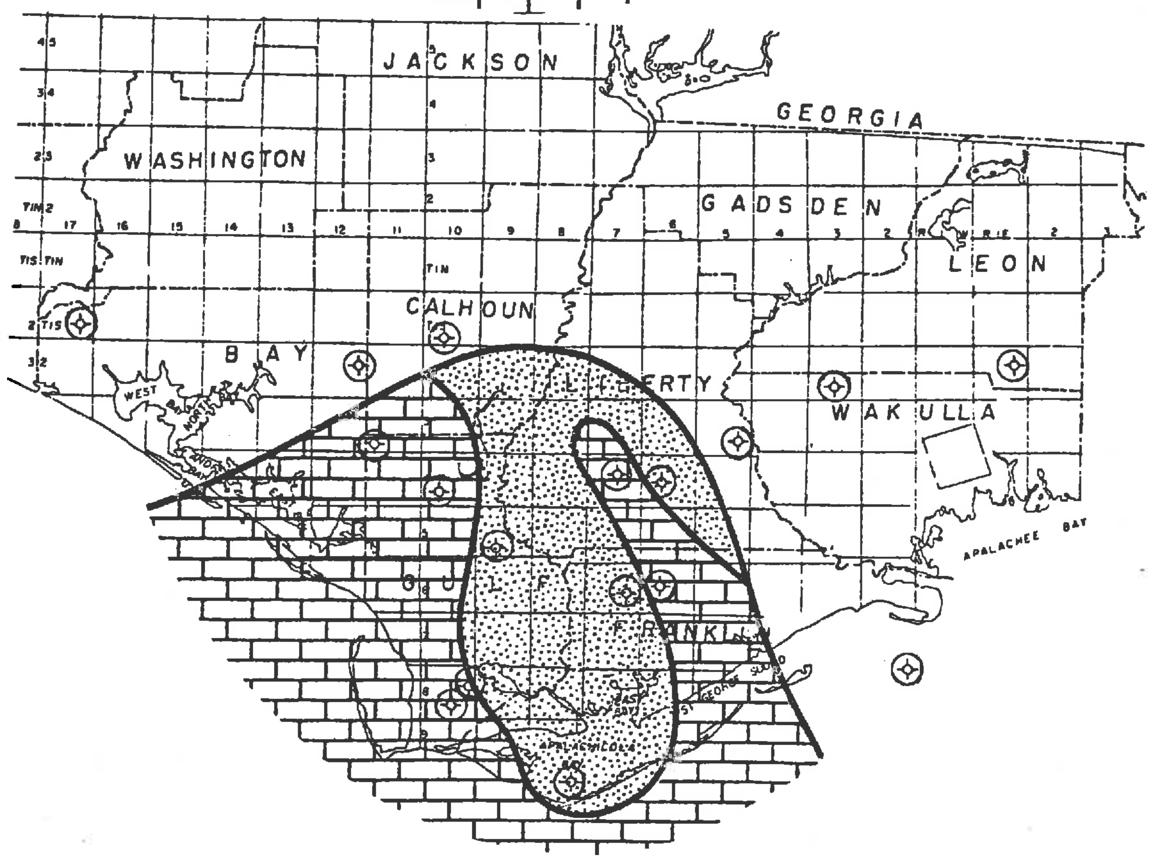
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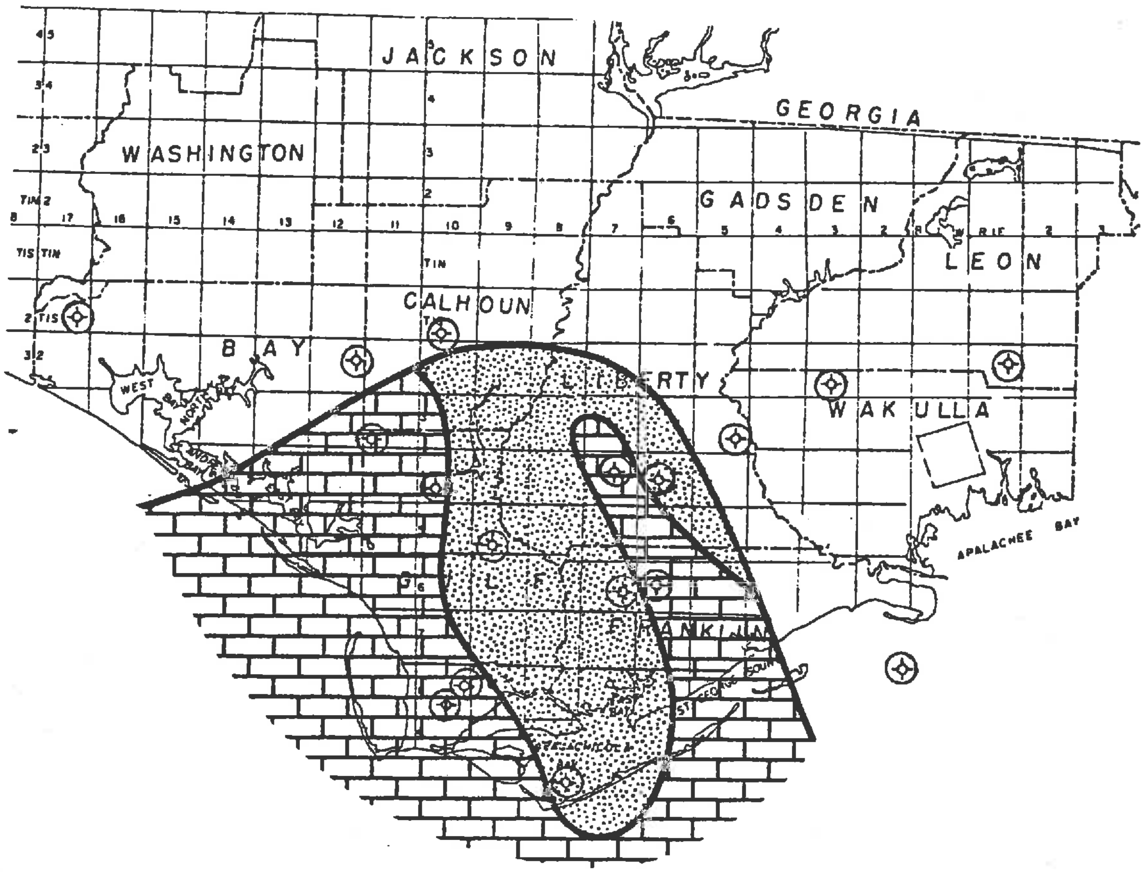
F I G U R E 22

90% "Lithostratigraphic Level" map of Sm 1 showing updip limits of the Smackover.

F I G U R E 23

100% "Lithostratigraphic Level" map of Sm 1 showing updip limits of the Smackover. Maximum transgression as indicated by advance of the carbonate area has covered most of the embayment.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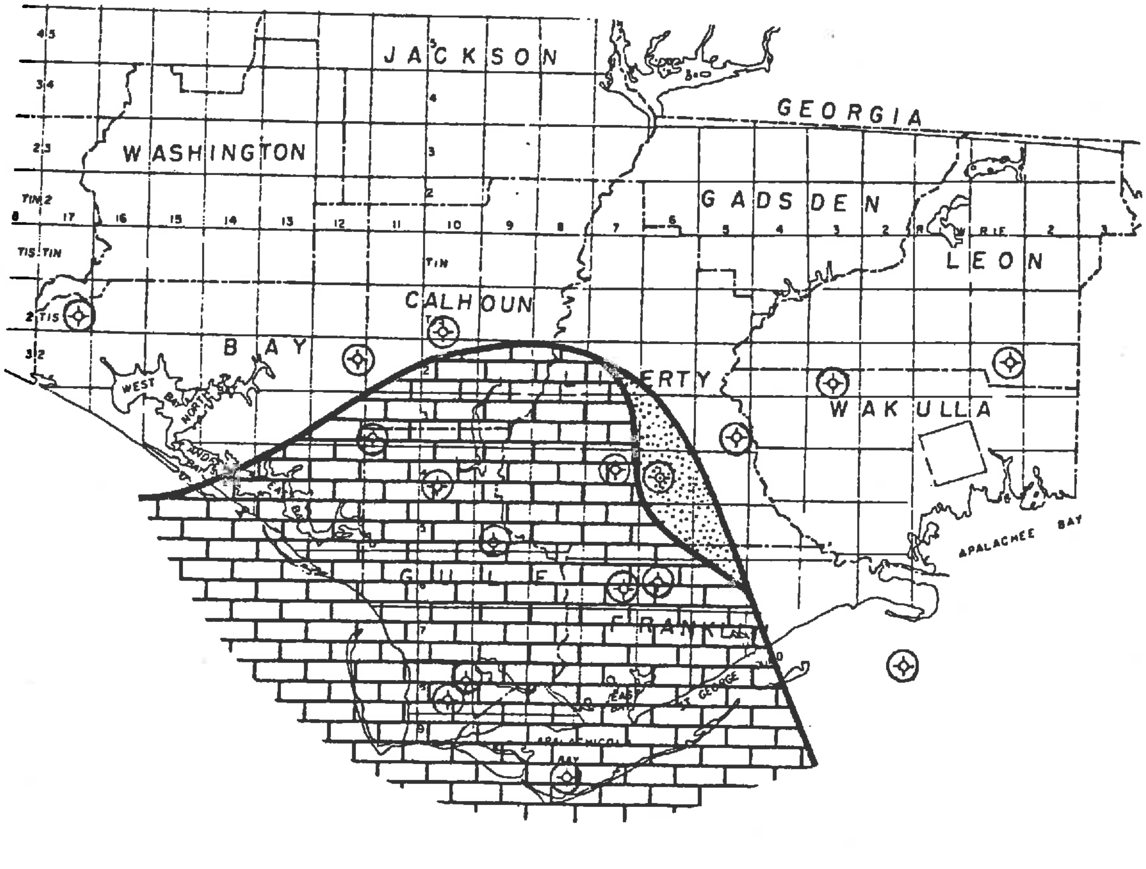
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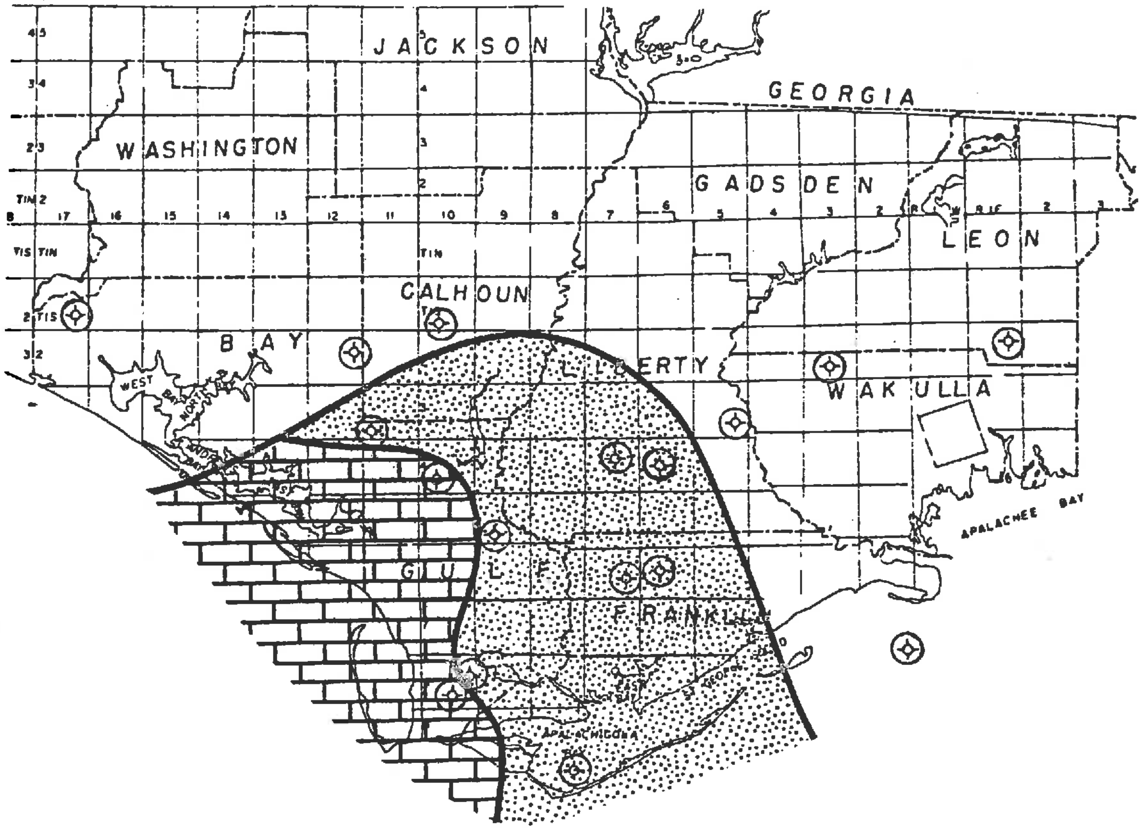
F I G U R E 24

10% "Lithostratigraphic-Level" map of Sm 2 showing updip limits of the Smackover. Regression appears rather abrupt as indicated by carbonate facies retreating, to the western half of the embayment.

F I G U R E 25

20% "Lithostratigraphic-Level" map of Sm 2 showing updip limits of the Smackover. Further regression is indicated in southern Gulf County by retreat of carbonate area around the Charter (670) well.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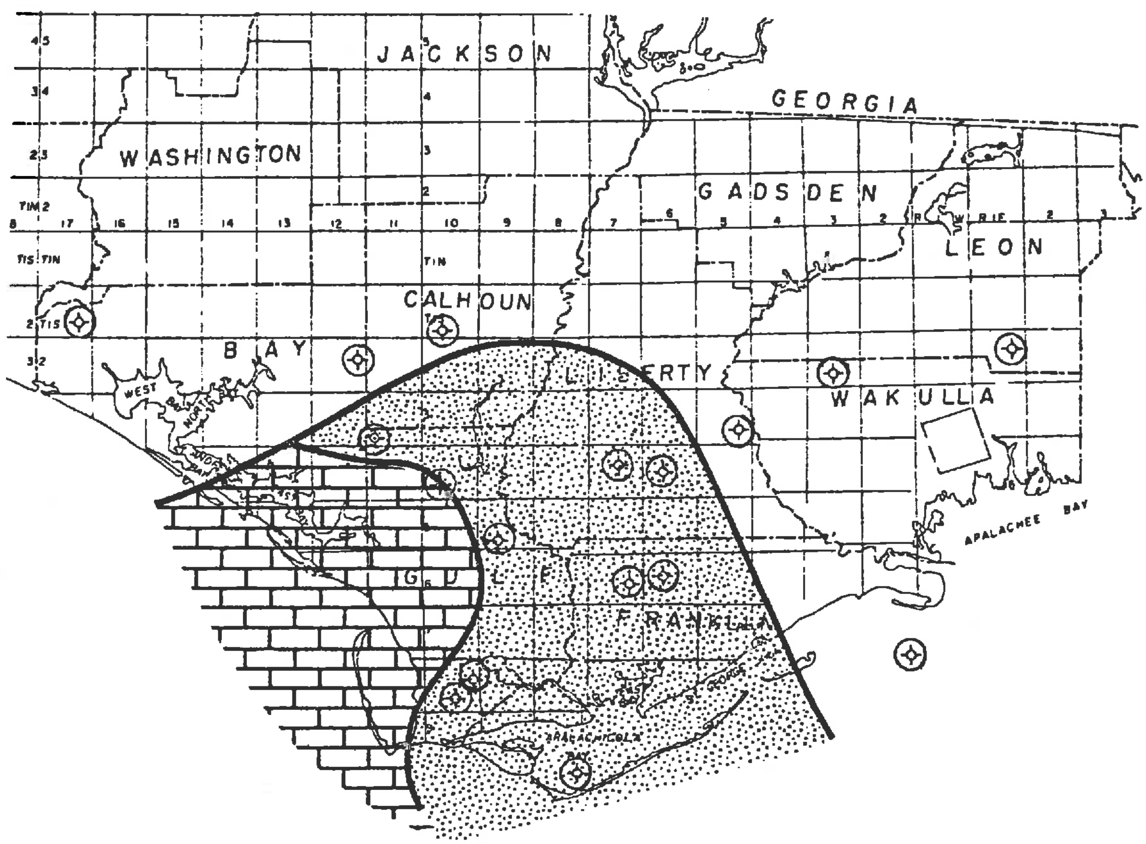
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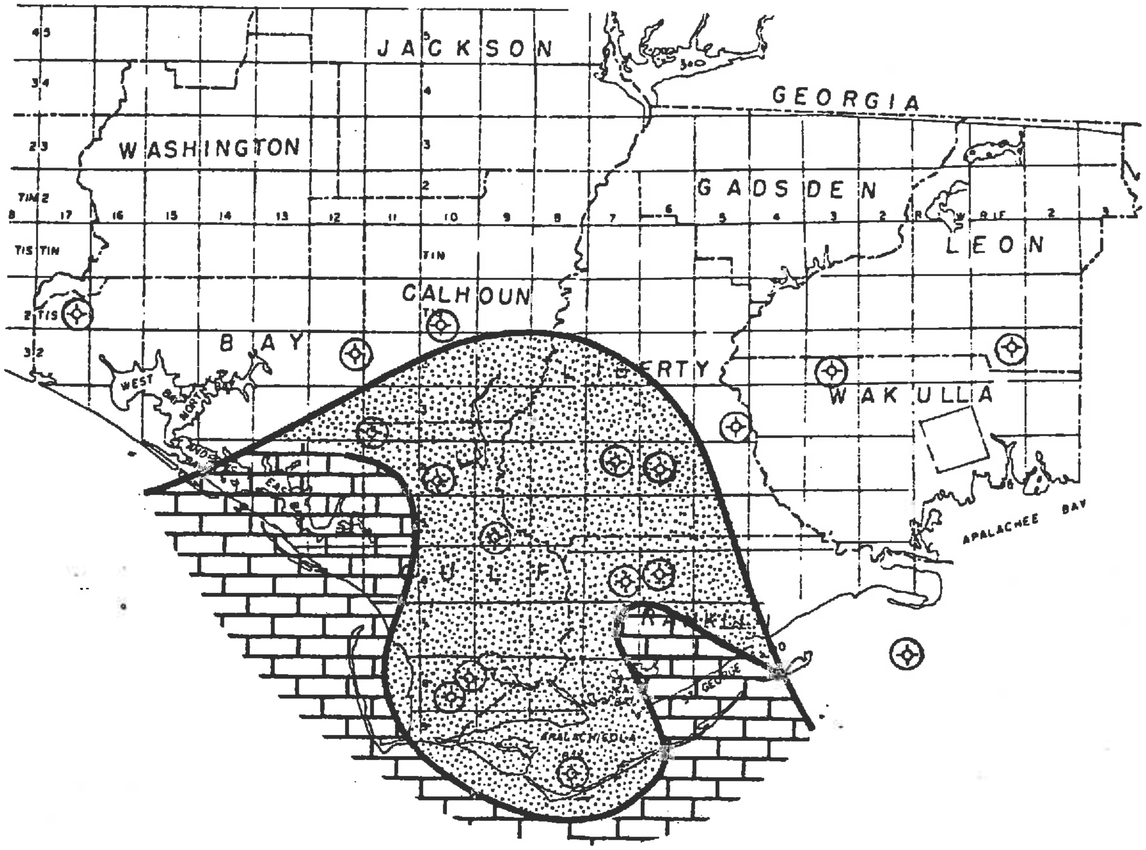
F I G U R E 26

30% "Lithostratigraphic-Level" map of Sm 2 showing updip limits of the Smackover. Minor transgression indicated by advance of carbonate area around the Mesa (960) and Exxon (814) wells in the eastern side of the embayment.

F I G U R E 27

40% "Lithostratigraphic-Level" map of Sm 2 showing updip limits of the Smackover. Approximate time of faulting as inferred by thickness of Sm 2 in Hunt (746) well. Facies west of fault trace inferred. Note eastern area where sheet-sands are present in Exxon (814) well.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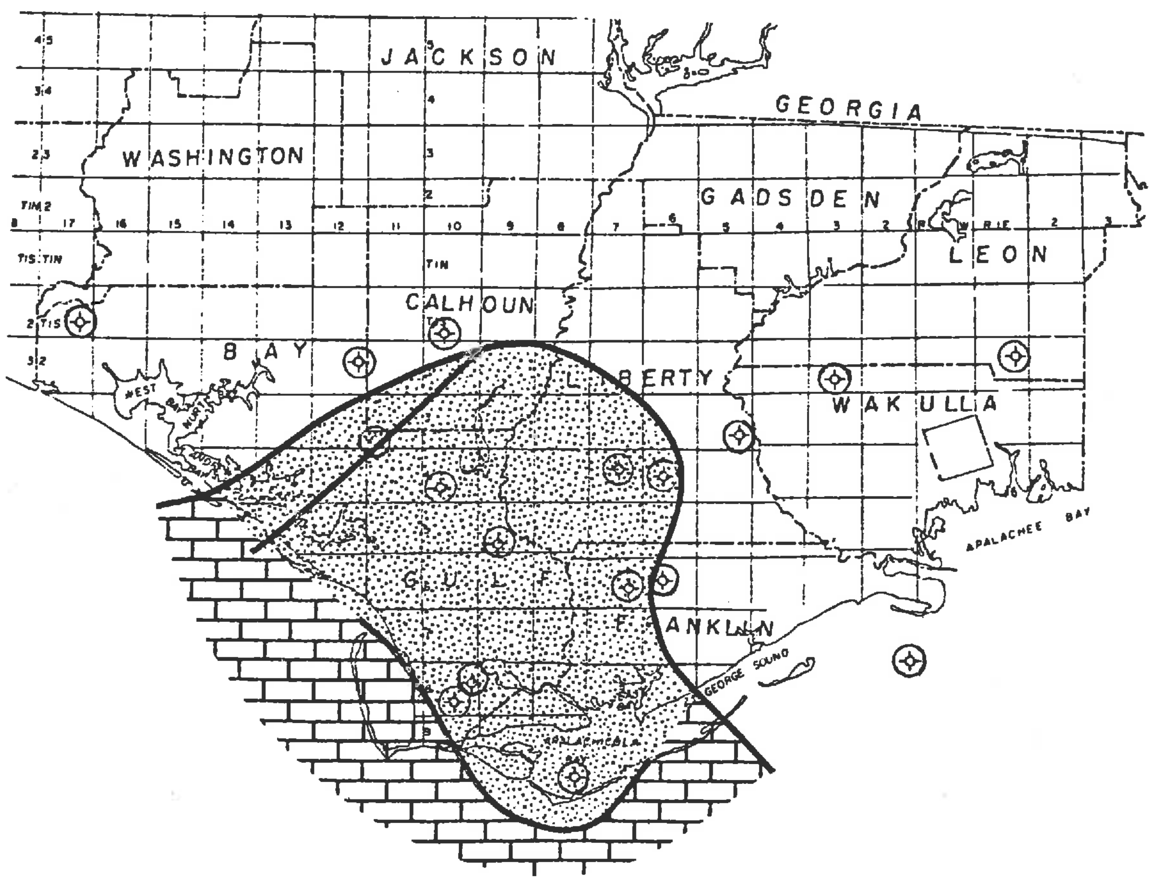
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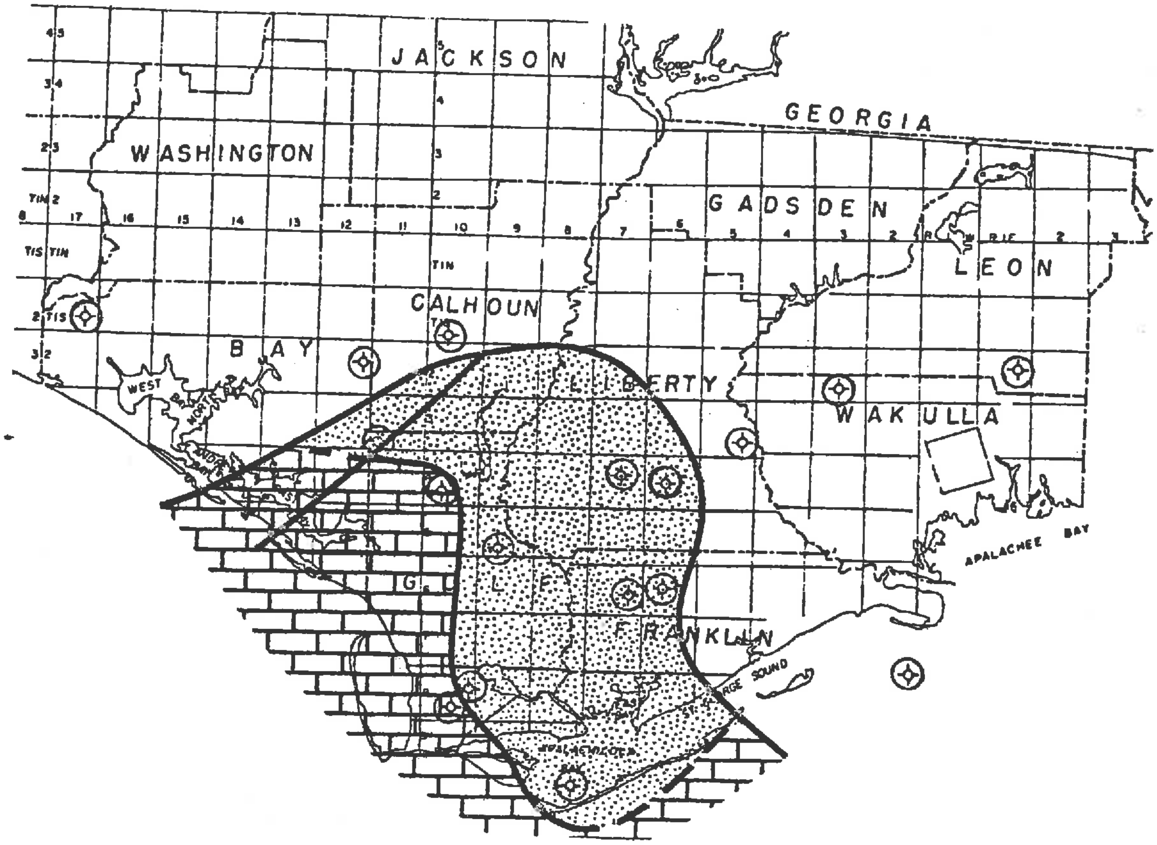
F I G U R E 28

50% "Lithostratigraphic-Level" map of Sm 2 showing updip limits of the Smackover. Minor transgession is western side of embayment as indicated by carbonate facies advancing to area around the Exxon (846) and Charter (670) wells.

F I G U R E 29

60% "Lithostratigraphic-Level" map of Sm 2 showing updip limits of the Smackover. Carbonate facies advance to area around the Charter (762) well in southern Gulf County.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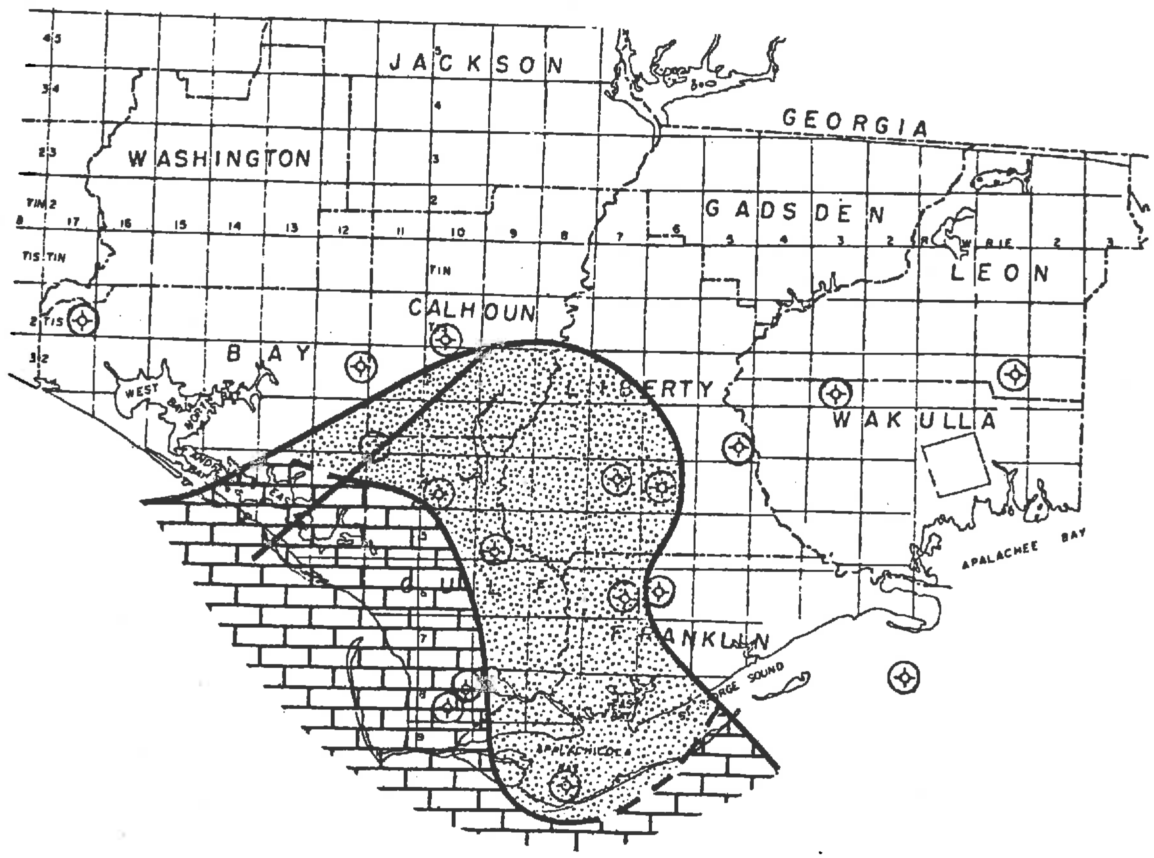
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F I G U R E 30

70% "Lithostratigraphic-Level" map of Sm 2 showing updip limits of the Smackover. Minor regression as carbonate facies retreats further to the southwest of the embayment.

F I G U R E 31

80% "Lithostratigraphic-Level" map of Sm 2 showing updip limits of the Smackover.


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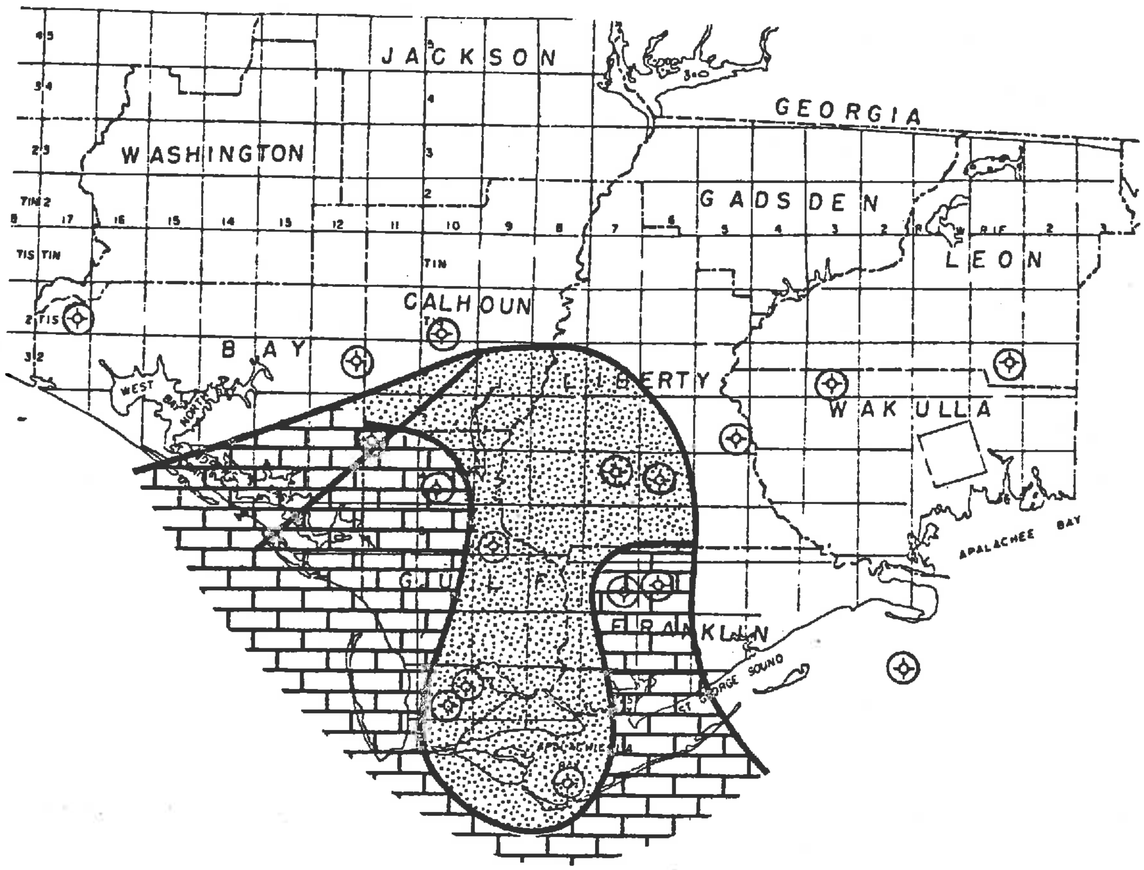
F I G U R E 32

90% "Lithostratigraphic-Level" map of Sm 2 showing updip limits of the Smackover. Moderate transgresssion observed as carbonate buildup areas or banks advance both in eastern and western sides of the embayment.

F I G U R E 33

100% "Lithostratigraphic-Level" map of Sm 2 showing updip limits of the Smackover. At close of Smackover, carbonate facies advances in western side of the embayment before final regression occurs and embayment is covered by sheet-sands and red-brown sandstones and siltstones of the Haynesville Formation.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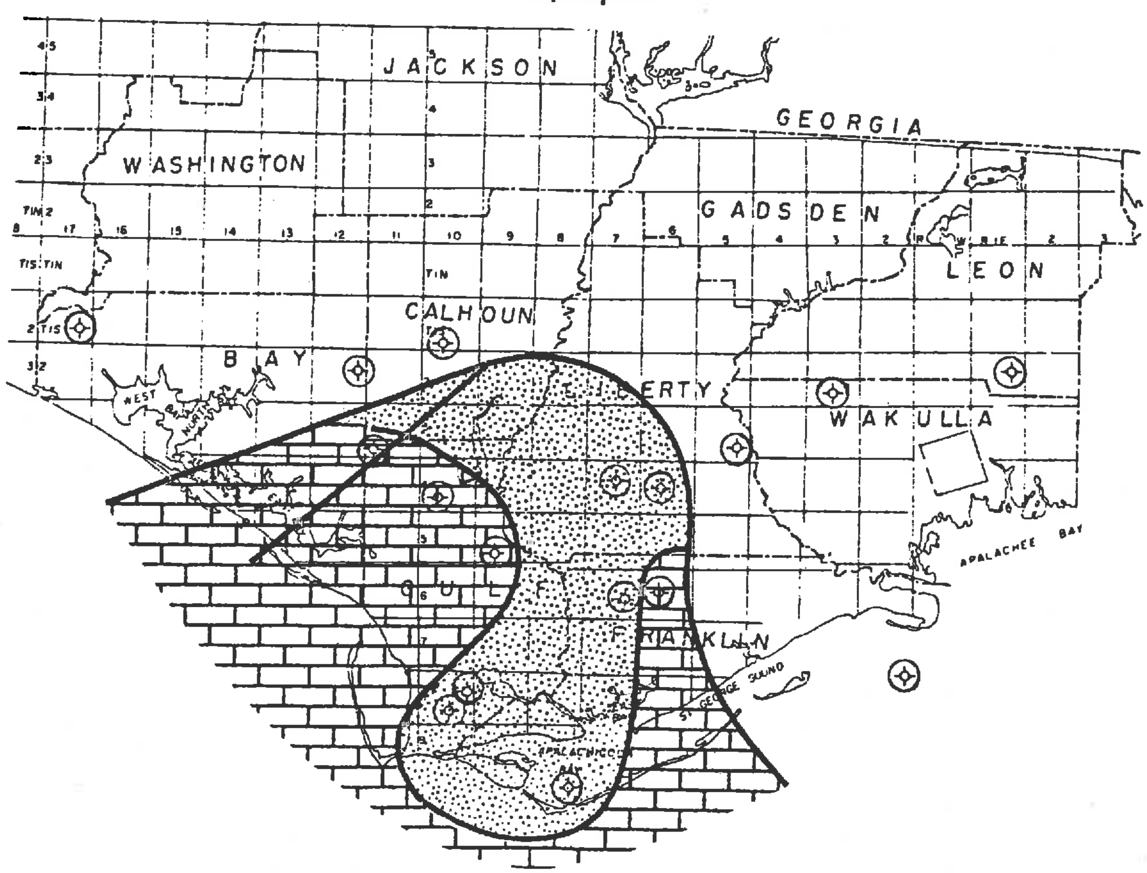
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direction. The lower unit, Sm 1, is a transgressive sequence; and the upper unit, Sm 2, is a regressive sequence.

Sm 1

The carbonates and fine grained, gray-olive green sandstones and siltstones of the Smackover Formation make a sharp lithologic break with the pink, orange, white and red sandstones and conglomerates of the underlying Norphlet Formation. This sharp break marks an abrupt diversion of the coarse clastics including the arkosic sandstones or a local unconformity. Dipmeter interpretation indicates an angular unconformity. Samples from the Exxon (814) well indicate an erosional unconformity.

Figures 14-23 show the minor transgression-regression episodes of Sm 1. The rhyolite "paleo-high" in the vicinity of the Charter (670) well was interpreted to have been covered by a thinly laminated (argillaceous layers) limestone unit, towards the end of Sm 1 deposition. This is reflected in the 80% "lithostratigraphic-level" map (figure 21).

By the end of Sm 1 (figure 23) carbonate deposition was taking place over most of the study area except in the vicinity of the Placid (745) well, where gray-olive gray siltstone was deposited.

An isopachous map of Sm 1 (figure 34) shows the distribution of sediment thickness in the embayment. The two most prominent features observed in this map are the very thin areas of sediment in the southern part of the embayment. The Charter Oil Co. (670) well drilled through 10 meters (32 feet) of Sm 1 before encountering a rhyolite porphyry. This igneous body was probably a high area around which sediment of Sm 1 were deposited and finally covered by the end of Sm 1 deposition.

The next most prominent feature found in Sm 1 is the thick area of sediments trending northeast-southwest and probably marking the axis of the embayment. Of the ten wells in the embayment which penetrated the lower Smackover Sm 1 unit, two wells the Exxon Oil Corp. (814) and the Hunt Oil Co. (746) are entirely carbonate units with little to no clastics.

A study of the stratigraphic cross-section B-B' (figure 35 in pocket) shows the interfingering of limestone units extending from the Hunt (746) well into the embayment. Most of these limestone units thin out and eventually disappear toward the axis of the embayment. The Exxon (846) well has 49 meters (156

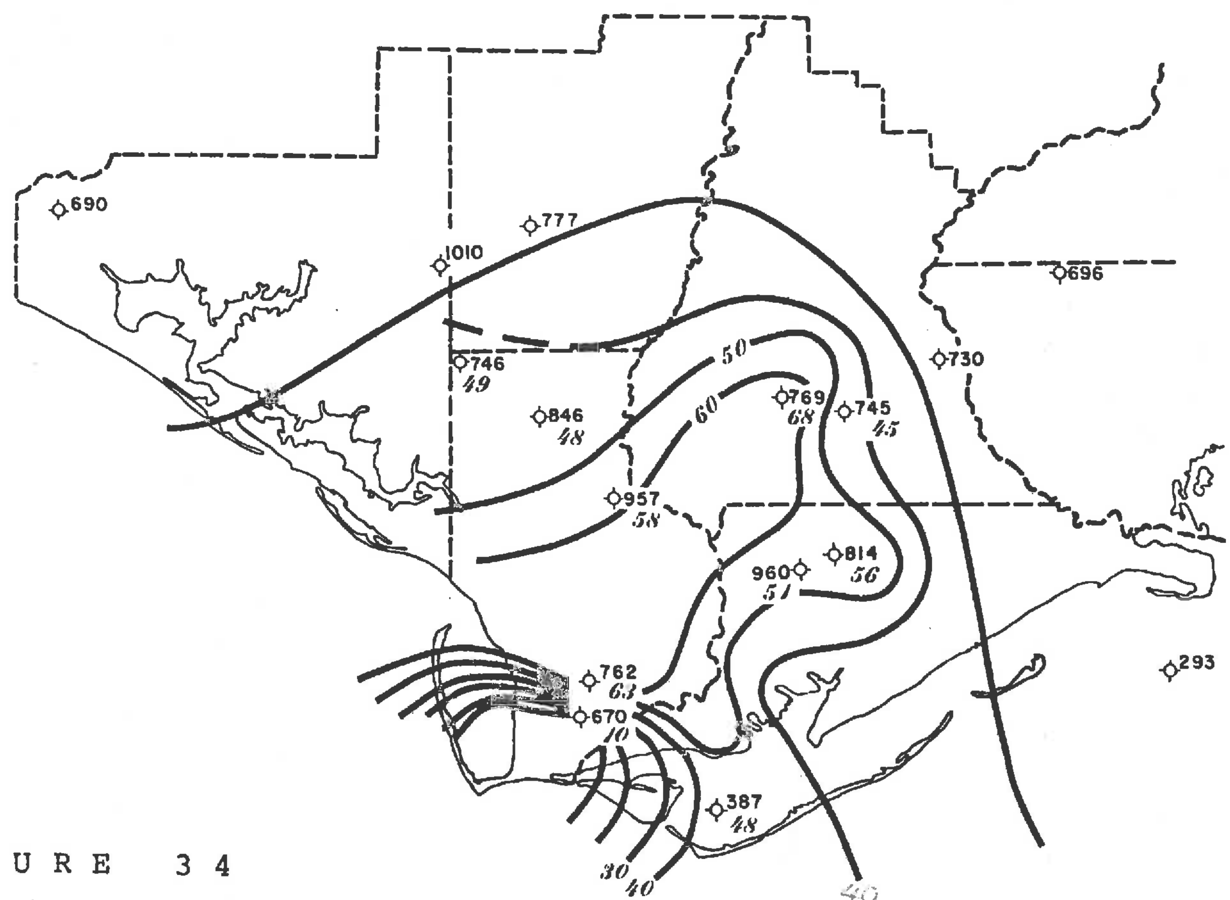


FIGURE 34
ISOPACHOUS
MAP OF Sm 1

C.I. 10 meters

feet) of Sm 1, 22 meters (72 feet) of which is limestone. The Mesa (957) well has 58 meters (190 feet) with 11 meter (36 feet), of limestone. On the east side the change is very abrupt. The Exxon (814) well has 56 meters (185 feet) of Sm 1 all of which is limestone, while the Mesa (960) well which has 51 meters (168 feet) of Sm 1, only has 7 meters (22 feet) of limestone (figure 36 in pocket).

The Placid Oil Co. (769) well penetrated 68 meters (223 feet) of Sm 1, the thickest accumulation found so far in the embayment. Limestone makes up 31 meters (101 feet) of this unit, all of it in the upper part (figure 10 in pocket). The lower 37 meters (122 feet) is composed of siltstones as previously described and minor amounts of sandstones.

A structure contour map on top of Sm 1 (figure 37) shows the gentle dip of the embayment to the southwest, with the two most pronounced faults, making up a grabben-like feature. Sm 1 appears to dip approximately 15 meters/kilometers (82 feet/mile) along the center of the embayment.

The closing of Sm 1 "time" was marked by a period of maximum transgression (figure 23), as evidenced by deposition of limestone in all of the wells in the embayment except the Placid Oil Co. (745) well, where

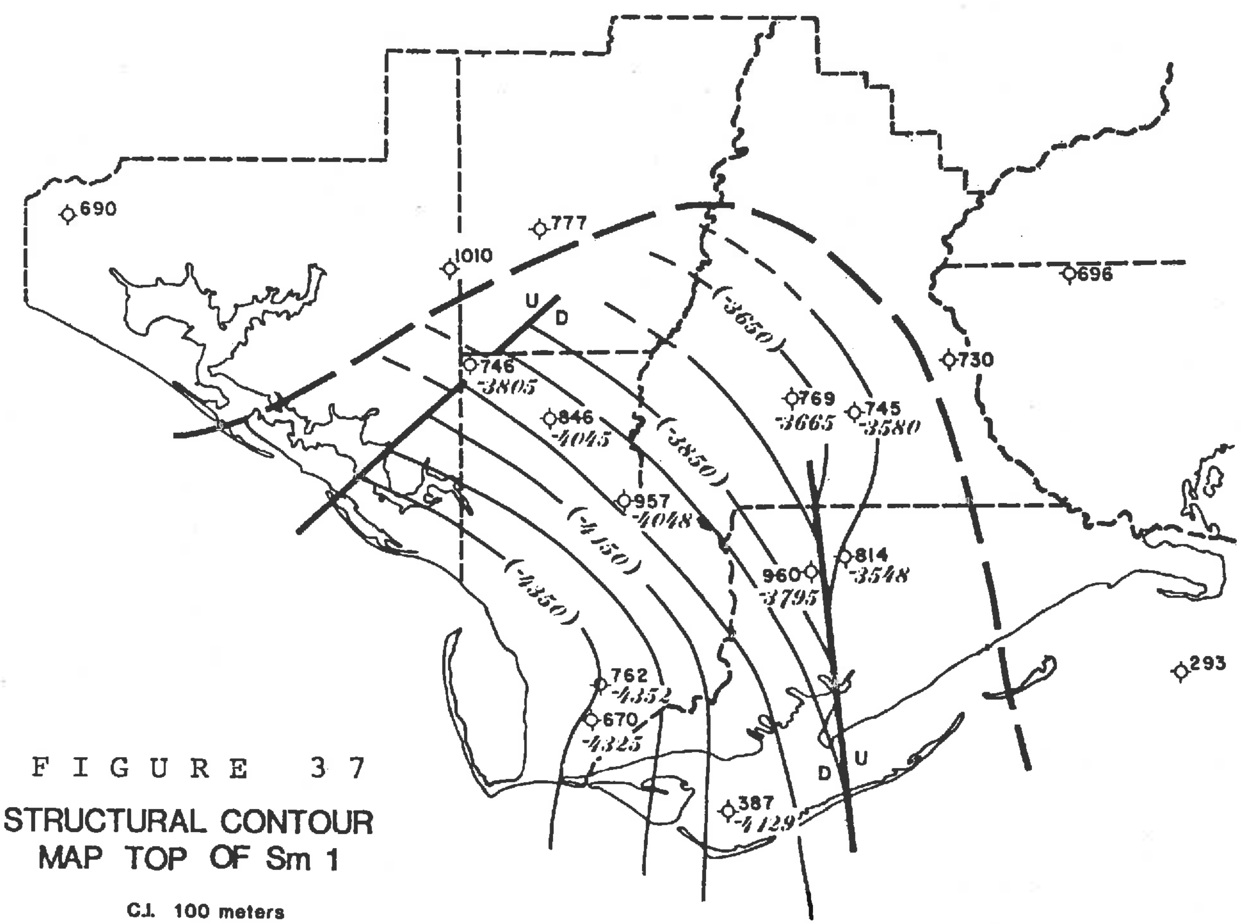


FIGURE 37

STRUCTURAL CONTOUR MAP TOP OF Sm 1

C.I. 100 meters

siltstone was recorded. The up-dip limits of Sm 1 deposition might be further north into central and western Calhoun County. However, no well has been drilled deep enough to penetrate the Smackover in this area.

Sm 2

Deposition of Sm 2 in the Apalachicola embayment is marked by the beginning of a regressive sequence. A series of "Lithostratigraphic-level" maps on Sm 2 demonstrate the regressive nature of this unit (figures 24 through 33).

The 10% "lithostratigraphic-level" map on Sm 2 (figure 24) would seem to indicate that regression at the beginning of Sm 2 was rather abrupt with an apparent shift of the "sea" to the southwest. Minor transgressive-regressive sequences can be observed in figures .

A minor transgression can be observed in the 90% and 100% "lithostratigraphic-level" maps of Sm 2 (figures 32 through 33). The lithofacies found in Sm 2 are for the most part identical to those of Sm 1. The main difference being the lack of carbonates.

The thickness of Sm 2 varies from 40 meters (130 feet) in the Mobil Oil Co. (387) well in the southern end of the embayment (figure 38 in pocket), to 119 meters (342 feet) in the Exxon (846) well in northern Gulf County. The Hunt Oil Co. (746) well has the thinnest Sm 2 section, but I believe that this well has been cut by the northeast-southwest trending fault, and is therefore not indicative of the thinnest area of depositon. An isopachous map of Sm 2 (figure 39), shows the distribution of sediment thickness of this unit in the embayment. The only prominent feature appears to be the thick area running northeast-southwest and the anomolous thin area found near the western fault in the general vicinity of the hunt (746) well. It is interesting to note that the "thick" area in the isopachous map of Sm 1 is centered further southeast than the "thick" area in Sm 2. This can be accounted for, by a shift in the pathway of sediment transport, possibly due to an adjustment of the depositional basin because of faulting. The only direct line of evidence for such a hypothesis, is the "short" section found in the Hunt Oil Co. (746) well.

This short section can be accounted for by either 1: Faulting during the end of Sm 2, making the area around the hunt (746) well receive less sediment; or 2: Faulting after deposition of Sm 2 with the well

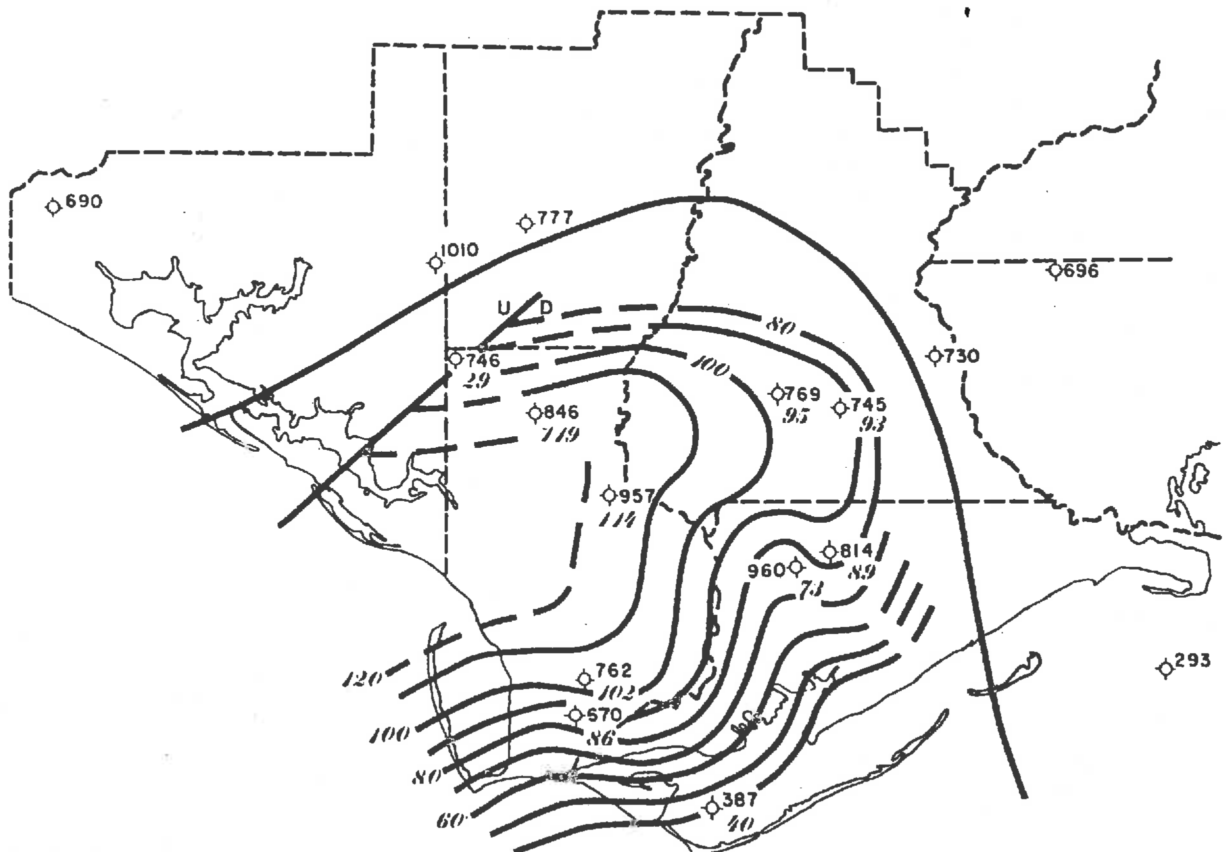


FIGURE 39
ISOPACHOUS
MAP OF Sm2
C.I. 10 meters

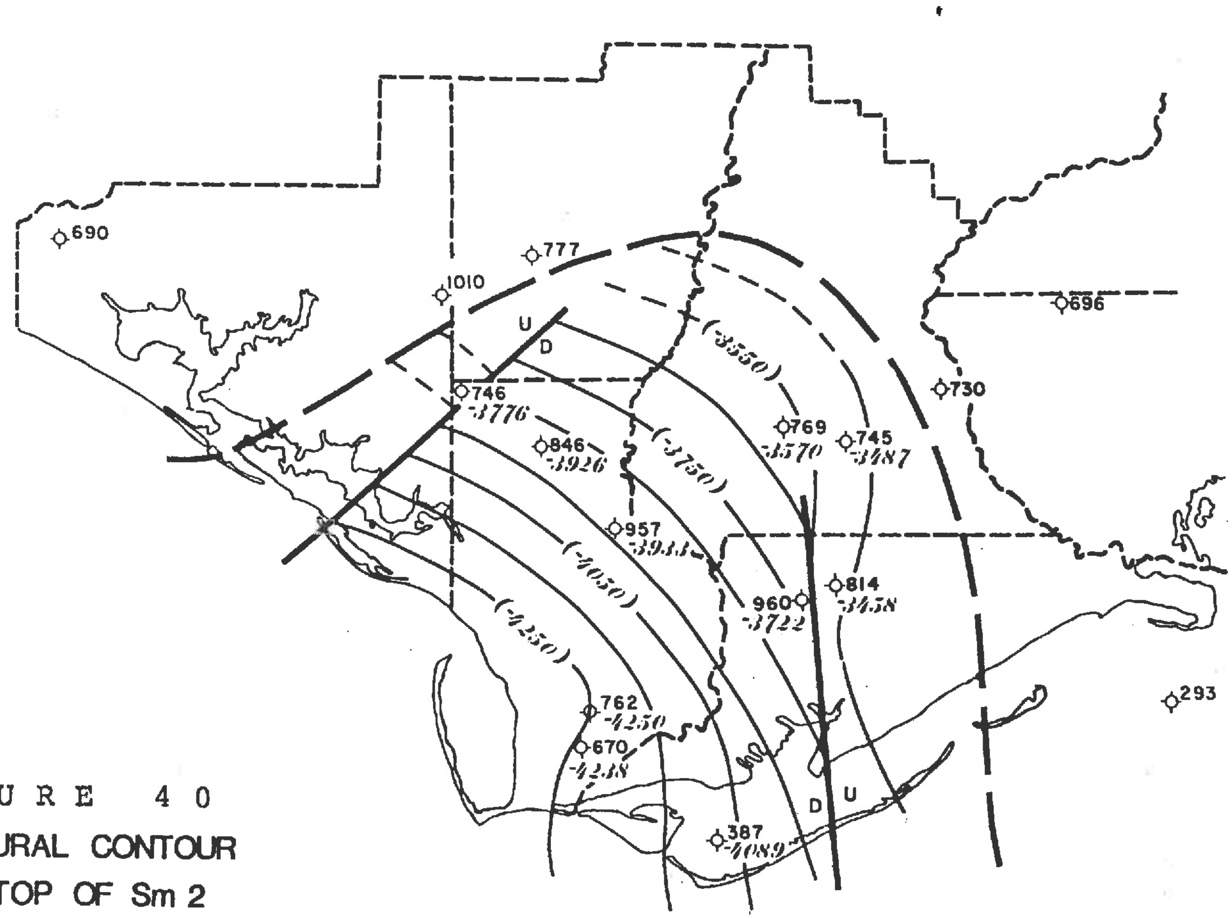


FIGURE 40
STRUCTURAL CONTOUR
MAP TOP OF Sm 2

C.I. 100 meters

penetrating the fault plane, encountering only the lower part of Sm 2. I believe that the timing of faulting was indeed during the end of Sm 2 deposition, as suggested by the shift of the "thick" area on the isopachous maps of Sm 1 and Sm 2.

The Exxon Oil Co. (814) well, encountered 89 meters (293 feet) of Sm 2. The lithology of Sm 2 in this well is marked by abundant beds of clear, medium to coarse grained sandstones. These beds appear to interfinger with the gray to olive-gray siltstones and sandstones of Sm 2, and are much more abundant in the middle, and to a lesser extent the upper part of Sm 2. The "lithostratigraphic-level" map at the 40% level and above (figures 23 through 33), demonstrate the incursions of sheet-sands into the embayment. It is possible then, to stipulate that the faulting in the western side of the embayment could have started around the "40% level" of deposition. This faulting caused a shift in the depositional axis of the embayment to the northwest, changing the configuration of the embayment allowing the sheet-sands to be deposited in the southeastern side of the basin.

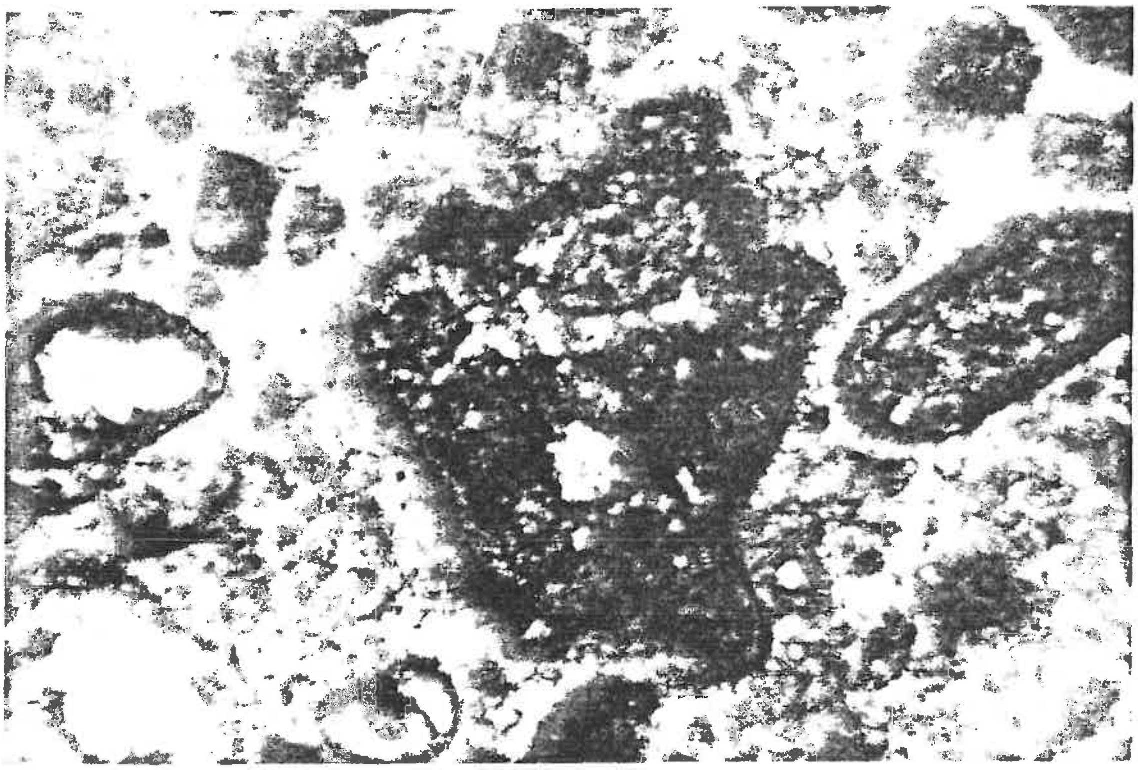
A structural contour map on top of Sm 2 (Figure 40) show the "synclinal" nature of the basin. Note that the Charter (670) well in southern Gulf County is structurally higher than the "updip" Charter (762) well. An apparent "high" is indicated towards the southeast of this area in the vicinity of the Mobil (387) well.

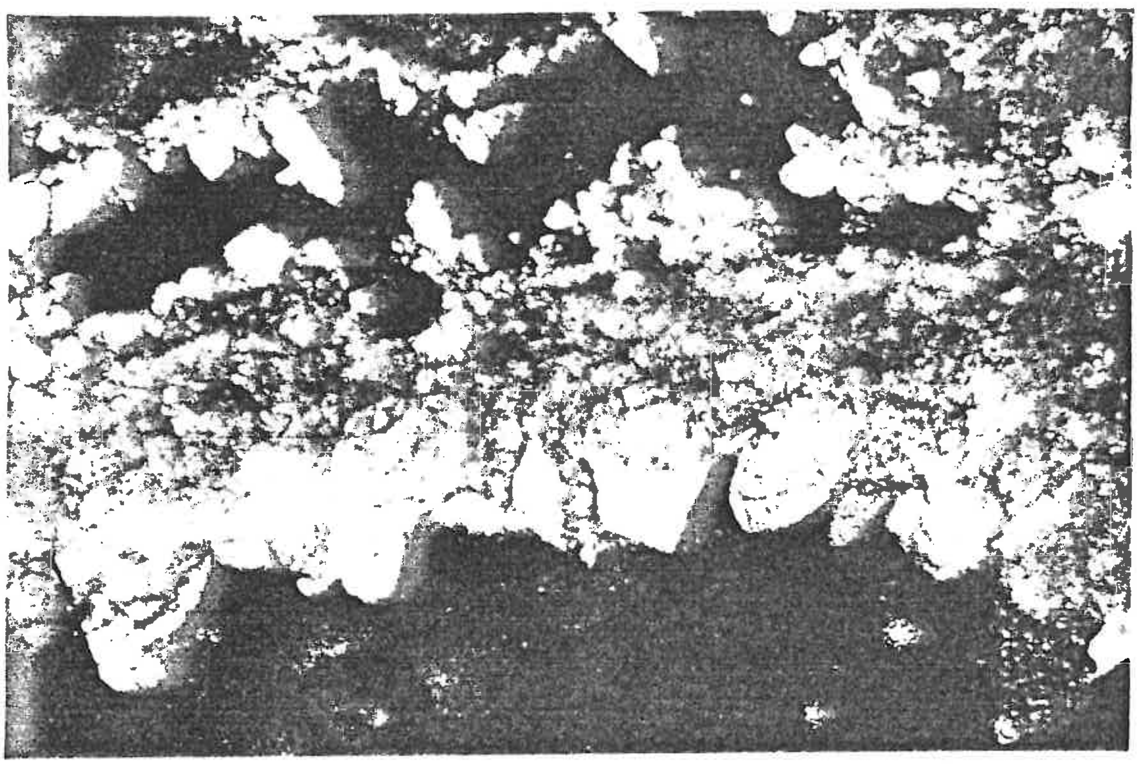
P L A T E 1 1

Peloidal packstone-wackestone. Scalenohedral calcite crystals growing around pore throat. Exxon Corp. P-814 11770-771.

P L A T E 1 2

Grapestone(?), algal covered grains. Neomorphic microspar after micrite. Exxon Corp. P-814 11723-724.





PETROLOGY

Diagenesis

The Sm 1 carbonate facies found in the Exxon (814) well has been affected by various degrees of diagenetic alteration. The major diagenetic feature seen in these rocks is neomorphism of micrite creating microspar-spar textures. Plate (1) is an example of a peloidal packstone-wackestone where neomorphic microspar (plate 8) has replaced most of the micrite matrix, now only seen as scattered patches of micrite "grumeleuse structure" (Cayeaux, 1935 from Bathurst, 1971) (plate 10).

The whole section exhibits signs of diagenetic crystal growth under fresh water phreatic conditions, as evidenced by scalenohedral calcite crystals more or less evenly distributed about the pore space. These crystals have sharp terminations towards the interior of pores (plate 11). Halley and Harris (1979) working in Joulters Cays, Bahamas found similar crystal habits and distribution growing in the phreatic zone of that island.

Moore et al (1981) present evidence for establishment of a meteoric water system in Smackover sediments of Arkansas and Louisiana. Sigsby (1976) also alludes to a meteoric water system in the Smackover of the Jay trend. However, he states that due to the arid climate during Oxfordian time the water table was at considerable depth and that porosity in the Jay trend area was preserved and enhanced because the reservoir rocks were in the vadoze zone. Water undersaturated with respect to calcium-carbonate would pass through the pellet deposits and dissolve the aragonitic pellets, leaving behind a pelmoldic porosity. Sigsby (1976) reports that small amounts of meniscoid cement can be recognized in the "pellet dolomites." Meniscoid cement (Dunham, 1971) can be recognized by the meniscus which forms at the interface between grains. I have found no evidence of a vadoze zone (i.e. meniscoid cement) in the Smackover of the Apalachicola embayment.

The carbonate section studied in the Hunt 746 well shows signs of light to moderate diagenetic alteration, mainly in the form of neomorphic replacement of micrite by microspar-spar (plate 12). Porosity was not well developed, and averages less than 1-2% with a couple of thin-sections having as much as 5%. Overall, the grains are better preserved in this well than in the Exxon (814) well.

Styolitic seams are more prevalent in the Hunt

(746) well than in the Exxon (814) well. It is possible that this pressure-solution feature might be a product of relatively early compaction. Such compaction could reduce the effective primary porosity, allowing for better preservation of the grains by restricting passage of diagenetically active fluids.

- Dolomitization of the Sm 1 carbonates is restricted to pore filling dolomite rhombs, and is not associated with evaporite deposition as is the case in other parts of the Northern Gulf Coast (Dickinson, 1969; Sigsby, 1976; Mancini and Benson 1980; Moore et al, 1981). The limited dolomitization found is thus interpreted to be the result of fresh-water mixing (Dorag Dolomitization) probably in the phreatic zone.

Evaluation of the porosity found in the Exxon (814) well indicates that all of the porosity found is secondary. A close examination of the pore throat and crystal growth, found in this well suggest that 3-4 diagenetic active fluids have migrated through the immediate vicinity of this well. This is indicated by:

1. Growth of scalenohedral calcite crystals.
2. Dolomite rhombs superimposed on some of the scalenohedral calcite, partially filling some of the pore space (passive cement) and in some occassions, completely plugging the pore space.

3. Oil stained scalenohedral calcite and or dolomite rhombs.
4. Further growth of new scalenohedral calcite growing "through" the oil stained pore throat or other crystals.

Smackover Paleoenvironment Interpretation

The very limited occurrence of "normal marine" fauna in the carbonates of the Smackover is suggestive of a very restricted sea (Sigsby, 1976) and (Wilson, 1975). In the Apalachicola embayment this fauna is characterized by decapod(?) pellets, algae, echinoderm plate fragments, ostracods, benthic foraminifera, gastropod fragments, thin-shelled pelecypods and peloids (probably fecal pellets but not recognizable as such in the sample studied). Bishop (1968), studying the petrology of the Smackover in parts of Louisiana suggested that soft bodied organisms may have produced some of the pellets (peloids in this paper) found in the Smackover. Bathurst (1971) points out that decapods (crabs) also play an important role in the develoment of fabrics in the intertidal zone, even though their carapaces may constitute an "insignificant fractionof the sediment." The recognition of peloids as intraclast or pellets is important, because recognition as fecal pellets would allow for a lower energy environment than intraclasts.

The lithostratigraphy of the Smackover in the Apalachicola embayment along with the limited fauna found is indicative of a low-energy restricted environment. The carbonate lithofacies principally represent a low energy, shallow subtidal environment. The clastic element found in Sm 1 is probably representative of an intertidal to marshy area. The occurrance of reduced sediments, grain size parameters, disseminated plant material and occassional pyrite suggest a low energy environment, with a fairly fast sedimentation rate. (Tanner Personal Communication). A core from the Mesa (957) well is composed of thinly interlayered dark gray to olive gray siltstone and light gray to greenish gray very fine grained sandstone layers 1-3 mm thick. The thinly interlayered bedding found in the gray-olive gray siltstones and fine grained sandstones of the Apalachicola embayment are common in intertidal flats and river estuaries (Reineck and Singh, 1975, Selley, 1978, Heckel, 1972. Reineck and Singh (1975) named these thinly interlayered beds "rhythmites," which they interpreted as having been produced from rhythmic seasonal changes. They added that a couplet was made up of rather fine-grained material, and individual layers are generally differentiated by light and dark color. Reasons given for this thinly interlayered bedding (rhythmites), are regular changes in the transport or production of material due to either tidal changes, a short duration event, or seasonal changes caused by changes in weather conditions. Reineck (1967) defined tidal bedding as fine rhythmically laminated bedding.

Essentially, thinly interlayed sand/mud bedding made up of sand layers 1 mm thick. The contact between sand and mud layers is rather sharp. The sharp contact between sand and silt layers can be observed in cores and ditch samples from the study area. Reineck and Singh (1975) added that the sand layers were deposited during periods of current activity, both flood and ebb currents. The mud is deposited during stand-still phases of high water and low water tides.

The overall fine grain size of this facies indicates deposition in a relatively low-energy environment. Selley (1978) points out that recent tidal flat deposits are characterized by rhythmites, associated with intense burrowing. The samples studied from this facies do not show signs of burrowing, but contain plant remains lignite(?), which are also associated with recent mud flats (Selley, 1978).

The limited fauna found in the Smackover carbonates is suggestive of a firm to soft substrate (Heckel, 1972). The presence of varying amounts of intraclasts (plate 10) in the carbonate facies of Sm 1 would suggest that the substrate must have been firm enough for parts of it to be transported short distances by currents. Water turbidity, as suggested by the fauna encountered, could have varied from clear to moderately turbid (Heckel, 1972).

The rather abrupt lithologic changes observed between wells on the edge of the embayment and wells toward the center of the embayment, as in the case of the Mesa (960) and Exxon (814) wells, can be explained by the input of clastic sediments down the center of the embayment (figure 14 through 23). Wilson (1975) states that production of carbonate rocks can be inhibited by building to sea level or by turbidity induced by change of climate or source area. It appears that the clastic "tongue" of sediments observed in the "lithostratigraphic-level" maps, centered in the embayment, may have created enough turbidity to inhibit carbonate production.

The apparent unconformity found between the Norphlet Formation and the Smackover Formation as indicated by a study of dip-meter from wells in the Apalachicola embayment and the occurrence of an oxydized zone on top of the Norphlet in a downdip well in Destin Dome Exxon well (outside study area), has enabled the author to interpret the series of "lithostratigraphic-level" maps as a rough "time" datum indicating "synchronous" depositional environments.

A study of the "lithostratigraphic-level" maps (figures 14 through 33) indicate that the Smackover Formation in the Apalachicola embayment was deposited during a major transgressive-regressive phase. This transgressive-regressive phase constitutes a complete sedimentary cycle and probably includes what would be considered the "time-equivalent" of the Buckner Formation in other parts of the northern Gulf Coast. Wilson (1975) states that the Smackover Formation and overlying Buckner Formation in Texas, constitute a complete sedimentary cycle because of their transgressive-regressive nature.

The lower transgressive phase (Sm 1 in this paper) is dominated by carboante buildup (Wilson, 1975) areas, with a central "tongue" of clastics. Thinly layered rhythmites (Reineck and Singh, 1975), containing plant-like lignite(?) material enable this facies to be interpreted as a tidal mud flat probably in the pro-delta area (Selley, 1978), surrounded by a low-energy fairly restricted marine environment. The upper regressive phase (Sm 2 in this paper) is characterized by considerably less limestone (10%) while still containing rhythmites similar to the ones described for Sm 1.

A study of the carbonate sediments found in the

Smackover reveals a number of facies which are indicative of various environments. The following general statements can be made about the environments of depositon.

1. The laminated micrite (mudstones) found in the Mobil (387), Charter (670), Placid (745) and (769) wells, composed of fine approximately parallel organic rich(?) argillaceous films are probably algal mats, indicative of a low supratidal to intertidal zone (Sigsby, 1976).

2. The micritic-pelletal-oncoidal (mudstone-packstone) sediment as observed in the Exxon (814) and Hunt (746) wells is probably indicative of subtidal, stable algal-flat environment (Sigsby, 1976).

3. The pelletal micrite (mudstone-packstone) as observed in the Exxon (814) and (846), Hunt (746) and Mesa (957) wells is probably indicative of a subtidal, below wave base environment (Sigsby, 1976) and (Bathurst, 1971). This facies can be found in broad shallow shelf and in quiet undisturbed lagoons (Bathurst, 1971) and (Halley and Harris, 1979). The presence of Cf. Girvanella is indicative of a back-reef or lagoon environment (Wray, 1971).

The restricted fauna found in the Smackover is indicative of facies numbers 7 and 8. The bedding and sedimentary structures, grain type and depositional texture are also indicative of facies numbers 7 and 8. The lithology, clastics and carbonates are more indicative of facies number 7.

STRUCTURAL INTERPRETATION OF THE APALACHICOLA EMBAYMENT

Initiation of the Apalachicola Embayment appears to have been as a result of tensional stresses during the Triassic, which formed a graben-like structure approximately centered around the present day Apalachicola River. The occurrence of a graben-like structure and its association with diabasic intrusions seem to indicate that the Apalachicola embayment are was under tensional stresses during that time. Dietz (1972) stated that the eastern United States has been under tensional stresses from the Triassic to present.

Diabase dikes and/or sills encountered in the Mobil Oil (387) well in the Eagle Mills Formation have been dated by Mobil at 180-200 million years old (Barnett, 1975). I believe that this date probably indicates minimum age for the initiation of the Apalachicola embayment. Other diabase intrusions have been observed by the author in the California Coastal (293) well offshore Franklin County, the Placid Oil (730) and (745) wells in Liberty County and in wells in Leon and Jefferson Counties.

Two areas within southeastern Franklin County exhibit positive and coincident Bouguer (figure 12), and magnetic (King, 1959) anomalies. The fact that both of these ~~this~~ anomalies are positive suggest a mafic composition for these bodies (Applegate, Pontigo and Rooke, 1978). The occurrence of diabasic intrusion in the California Coastal (293), Mobil (387), Placid (730), and (745) wells near the two anomalies described above, suggest that these anomalies could be a result of massive diabase intrusions in the Eagle Mills Formation.

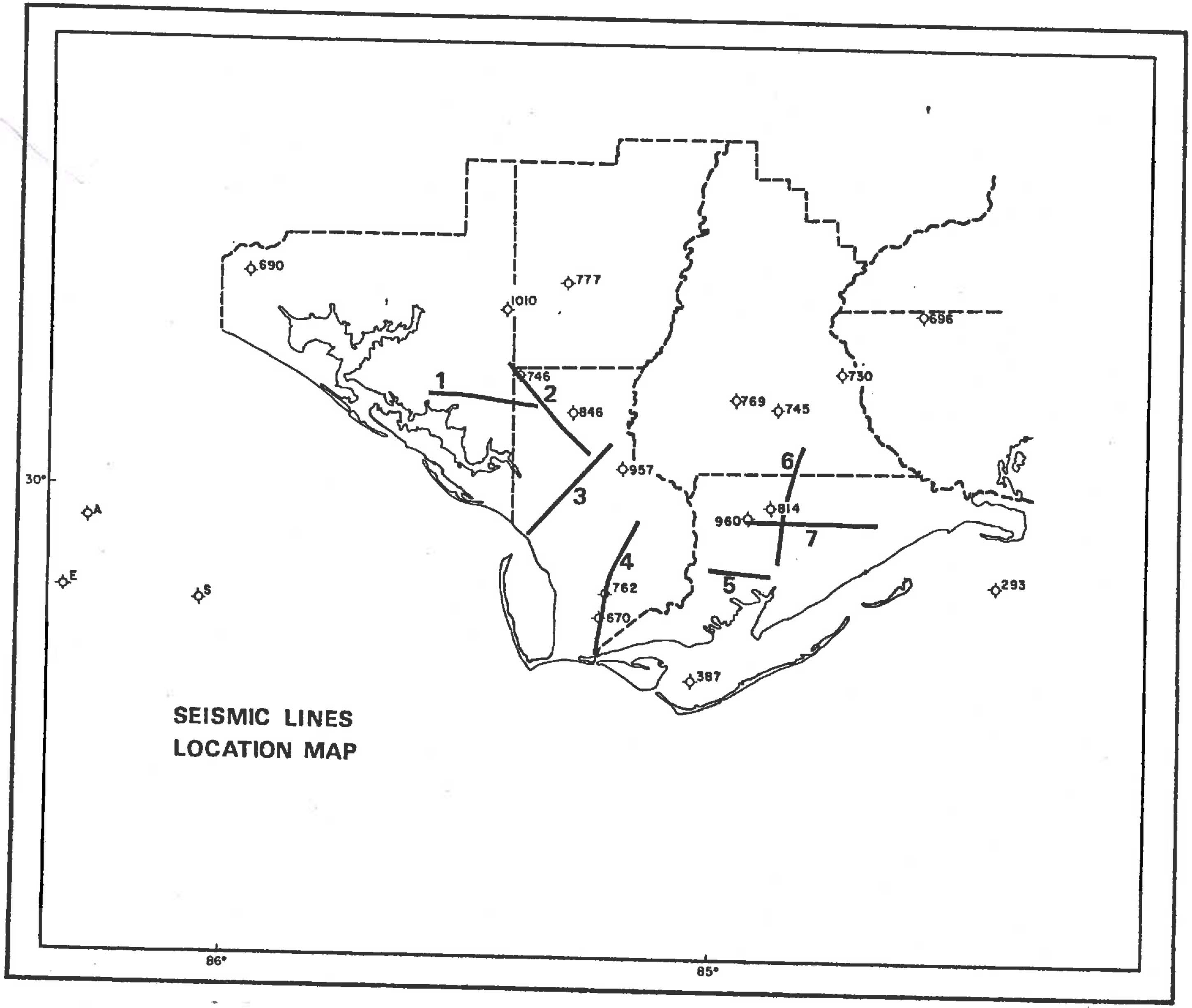
Figure 11 delineates the area of known and inferred Louann Salt deposition. The northwestern side appears to have been fault controlled, even though minor amounts of salt (2 meters; 6 feet) occurred in the Hunt Oil Company (746) well. The two areas represented by positive Bouguer anomalies (figure 12) probably controlled the southeastern side of Louann depositon. To the northeast in Leon and Wakulla Counties, Louann deposition appears to have been controlled by a fault inferred from gravity data. This fault is located northeast of the Placid Oil Company (696) well (figure 12), which contained 215 meters (705 feet) of salt. The fault controlled boundaries and the inferred "paleo-high" areas could have acted as barriers in-hibiting ocean circulation, allowing the deposition of massive salt in the area.

Due to its arkosic nature, the lithology of the Norphlet Formation in the embayment may suggest a period of renewed tectonic activity. The source of this material appears be the nearby granite "paleo-high" area to the northwest. This inference is based on the freshness of the feldspar and the very similar lithologic character of the arkosic sandstones, and the granite found in the Houston Oil (1010), the Charter Oil Company (690) and the Charter (721) wells ouside the study area. Dip-meter interpretations show the top of the Norphlet to be an angular unconformity, with variations from 5° - 14° in dip. A conglomeratic zone found on a core in the Exxon (814) well, suggest that the top of the Norphlet is also an erosional surface in parts of the embayment.

Salt tectonics appear to have taken place soon after deposition of a relatively thin over burden. This contention is supported by faulting affecting the Smackover-Haynesville sediments. Using the geophysical logs from the Hunt Oil Co. (746) well and Exxon's (846) well, I was able to correlate various units in the two wells which led to my finding a "missing section." This "missing section" is taken to be a fault cut in the Hunt (746) well. The "missing section" is found to be the Haynesville-Smackover contact at approximately -3794 meters (-12,449 feet) of depth, with approximately 143 meters (470 feet) of strata missing. Figure 41 is a location map of seismic lines provided to the author by Exxon Company U.S.A. to confirm faulting in the embayment by other geophysical means. Seismic line 2 (figure 42) shows the major garben-like feature observed in the vicinity of the Hunt 746 and Exxon 846 wells.

F I G U R E 41

Seismic line location map. Seismic lines were used to support faulting. Only seismic line 2 is published in this study.

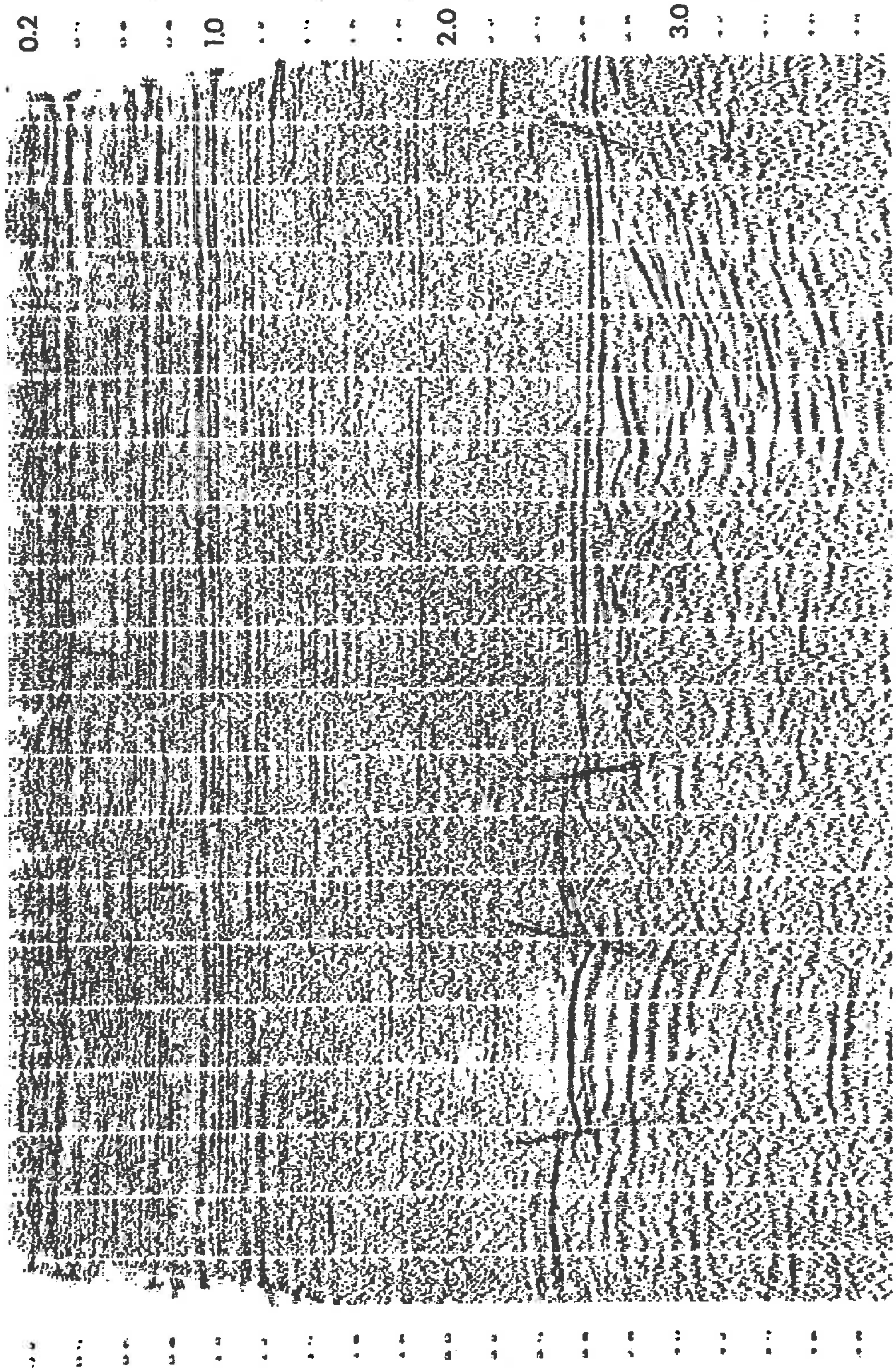


SEISMIC LINES
LOCATION MAP
690
777
1010
746
1
2
846
3
957
4
762
670
769
745
730
696
6
814
960
7
5
387
293
A
E
S
30°
86°
85°

140

F I G U R E 42

Seismic line oriented northwest-southeast near vicinity of Hunt (746) and Exxon (846) wells. Note horst and graben-like structures. Basement reflector close to 2.4 - 2.7 seconds. Numbers right hand of line refer to two-way time. (D.2 sec intervals)


0.2
1.0
2.0
3.0

SUMMARY AND CONCLUSION

The Apalachicola Embayment appears to have been initiated as a result of rifting during the late Triassic to early Jurassic, possibly associated with the opening of the Atlantic Ocean. The orientation of the grabens and half grabens indicate approximately an east-west tensional stress. During deposition of the Eagle Mills Formation "red beds" most of Bay County and immediately to the north was a paleotopographic "granite high". This "paleo-high" area was bounded on the east by a faulted down graben-like feature. The Eagle Mills Formation has a number of diabase intrusions, which have been dated in one well as 180-200 million years old. This date probably indicates the minimum age of the tensional features observed in the embayment. During the Middle Jurassic the "Louann Sea" probably entered the area of study from the southwest following the Eagle Mills "paleotopography" which consisted of graben, half grabens, and topographic high areas.

Deposition of the arkosic sands in the Norphlet Formation is probably indicative of renewed tectonism, perhaps exposing granite to the north of the embayment.

An isopachous study of the Norphlet indicates that the source of material for this unit is to the north - northeast as evidenced by a thick trend oriented in that direction. Erosion followed deposition of this unit, with subsequent deposition of the Smackover Formation.

The Smackover Formation in the Apalachicola embayment is characterized by shallow water carbonates, and clastics. A "lithostratigraphic-level" map study of this unit indicates that the Smackover is a transgressive-regressive unit in the Apalachicola Embayment.

The environment of deposition of the Smackover Formation varies from intertidal flats to lagoons to very shallow subtidal. The inferred open sea was to the south.

Porosity evaluation of the carbonates in the Smackover indicate that the area had a meteoric water system established, which aided in the diagenetic changes observed in the rock record, and enhanced secondary porosity. A close study of the interrelationship of pore-throat, secondary cement and oil staining indicates that the area around the Exxon (814) well was probably flushed by a number of diagenetically active fluids. Oil saturated water appears to have migrated through this area as evidenced by the staining of the pore-throat and subsequent growth of scalenohedral calcite into the pore space.

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A P P E N D I X

T A B L E 4

Potassium-Argon Age Determination
Report of Analytical Work

Sample Description & Locality:
Composite of cuttings from an oil test well, Hunt Oil Co. Permit 746 from 12, 950-12,990 feet.

Material Analyzed:
Feldspar concentrate, -60 mesh.

Ar^{40*}/K^{40} = .05036 AGE = 709 ± 25 M.Y.

Argon Analyses:

Ar^{40*},ppm.	Ar^{40*}/Total Ar^{40}	Ave. Ar^{40*},ppm.
.3149	.975	
.3671	.971	.3410

Potassium Analyses:

%K	Ave. %K	K^{40},ppm.
5.466		
5.634	5.550	6.771

Constants Used:

$\lambda_\beta = 4.72 \times 10^{-10}$/year
$\lambda_e = 0.585 \times 10^{-10}$/year
$K^{40}/K = 1.22 \times 10^{-4}$g./g.

$$AGE = \frac{1}{\lambda_e + \lambda_\beta} Ln\left[\frac{\lambda_\beta + \lambda_e}{\lambda_e} \times \frac{Ar^{40}}{K^{40}} + 1\right]$$

NOTE: Ar^{40*} refers to radiogenic Ar^{40}.
M.Y. refers to millions of years.

DATA SOURCE: H. Kelly Brooks (1981) dated by Krueger Enterprises, Inc. Geochron Laboratories Division

PETROGRAPHIC THIN-SECTION DESCRIPTIONS

EXXON CO. USA BUCKEYE CELLULOSE 16-3 PERMIT 814

Depth in Feet

11697-698 - Peloidal Packstone-Wackestone (Pelmicrite)
Peloids; small oval to round, cloudy some containing microspar patches. Range in size from .2 mm to .4 mm. 5% Forams; Cf. Milliolid species, chambers recognizable. Less than 1% Oolites; very faint outline only the micrite envelope and a nucleus recognizable. Less than 1% Algal plates; rectangular to oval with calcspar filled pore space, running lengthwise. Less than 1% Mullusk fragements; Ostracods(?); very small articulated shells. Less than 1% Algal bound grains; Oncolites(?) or Intraclast. Sample highly micritized; interparticle porosity occluded by neomorphic microspar. Some of the moldic porosity also occluded by microspar.

11698-699 - Peloidal Packstone-Wackestone (Pelmicrite)
5-25% Peloids; small oval to round cloudy, no internal structure. 2-3% Algal plats; rectangular to oval; some very diffused. Less than 1% Forams; Cf. Milliolid species. Less than 1% Mullusk fragments; Ostracods(?) small very thin articulated and inarticulated shells. Gastropod fragment upper whorl(?). Echinoid fragments; very few fragments. Less than 1% Algal covered grains, Oncolites(?). Microstyolites filled with dark brown material - tar (?).

11701-702 - Peloidal Packstone (Pelmicrite)
30% Peloids; rounded to oval, probably forms and fecal pellects. 10% Forams; Cf. Milliolid species, highly micritized. 5% Algal plates, rectangular for most part, some have very diffused edges. Less than 1% Mullusk fragments Ostracods(?), Pelecypods(?) and gastropod, .8mm x 2mm recognized by micrite envelope partly recrystallized by spar. Less than 1% Algal bound grain. Oncolithic concentric structure.

11741-742 - Wackestone-Mudstone (Micrite)
10% Intraclast - irregular shape; micrite patches. 5% Peloids - highly micritized, not well defined outlines. 10-15% Porosity moldic and interparticle, some of the pore space filled wiht scalenohedral spar. Neomorphic flower spar, oil stain.

11743-744 - Mudstone (Sparite)
Peloids - round to oval, diffused edges. Less 1% Mullusk fragments. Matrix composed of microspar with some patches of micrite. Abundant oil stained styolites. 5-10% Porosity.

11748-749 - Wackestone (Micrite)
10% Peloids very clotty appearance - grumeleuse texture. Abundant microspar-spar rhombs. Aggrading neomorphism. Matrix composed of micrite with very poorly preserved peloids which appear to diffuse into micrite.

11761-762 - Mudstone-Wackestone (Micrite)
10% Peloids; very diffused edges; only size and general morphology (oval-round) allow identification. Some could be small intraclasts. 5-10% Porosity microvugular to channel. Oil stained pore throats. Some fo the pore space are clsoed with large Dolomite crystals, remaining porosity space have scalenohedral calcite growing inward but not completely enclosing pore space. Apparently two histories of cement, an early vuggy network with upon which scalenohedral calcite precipitated occluding some of the pore space, and a later precipitation of large (rhombic) crystals of dolomite(?).

11764-765 - Wackestone-Mudstone (Micrite)
10% Peloids very badly micritiezed. 5% Neomorphic flower spar with micrite nucleus. 5 porosity. Styolitic filled with black to dark brown tar(?). Gruneleuse texture.

11767-768 - Mudstone (Sparite)
5% Peloids - scattered, very diffused edges. 5% Pore - microvuglar - moldic porosity(?), pore space with micrite envelope. Some channel porosity. Less than 1% forams - Cf. Milliolid. Matrix composed of neomorphic microspar grading into micrite patches.

11768-769 - Wackestone (Micrite)
10% Peloids extremely diffused edges (probably more abundant than 10%) grumeleuse texture - (aggrading neomorphism). Abundant Cf. Girvanella species - diffused tube-like features, some round cross-sections. 10-15% Porosity - secondary pore enlargement (channel porosity), spar ingrowing into some of the pore space (scalenohedral).

11770-771 - Peloidal Packstone-Wackestone (Pelmicrite)
10-20% Peloids - round-oval. 71% Mullusk fragments, Ostracods(?) articulated very small shells. 10-20% Dolomite - large crystals plugging pore space. Matrix composed of micrite and neomorphic microspar-spar. 10-15% Porosity - microvugular to channel porosity, most pore spaces have scalenohedral calcite ingrowths. Aggrading neomorphism.

11779-780 - Wackestone (Micrite)
10% Peloids very diffused, most concentrated (visible) in micrite. 10-15% Porosity - microvugular to channel some with scalenohedral calcite. Matrix composed of micrite with abundant microspar-spar (neomorphic after micrite); neomorphic flower spar. Styolitic - dark brown to black seams of tar(?).

11782-783 - Mudstone (Micrite)
Peloids(?); highly micritized rock. Matrix - grumeleuse texture, appears to be bored(?) or channel porosity now occluded by large spar crystals. The rest of matrix is about 60-70% micrite with 20-30% neomorphic microspar-spar. Micrite patches have a very sharp contact with spar areas.

Scalenohedral crystals are seen forming around some of the micrite patches. (Intraclasts).

11792-793 - Dolomite
80% microspar (dolomite) with large areas of spar (30 microns). Neomorphic icrospar about 5-10 microns. 15-20% Porosity.

11798-799 - Peloidal Packstone (Pelsparite)
10-20% Peloids - very diffused, oval-round micrite bodies. 5% Algal bound grain; intraclasts(?) micritic - microspar allochenn with micrite envelope. 5-10% Porosity - microvugular in part. scalenohedral ingrowths, oil stained pore throat. Matrix; neomorphic microspar (after micrite). Styolitic dark brown to black tar(?) filled.

11800-801 - Wackestone-Mudstone (Sparite)
10% Peloids; very diffused. Matrix - scattered patches of micrite with neomorphic microspar (after micrite) and large spar crystals filling(?) some of the pore space. Styolitic seams dark brown to black tar(?) filled.

11803-804 - Mudstone (Sparite)
Matrix about 30% micrite, 70% neomorphic microspar-spar scattered neomorphic flower spar micrite(?) nucleus. Slightly dolomitic, large crystals filling or partly filling space. 10-15% Porosity, channel and microvugular, probably, effective - mostly channel interconnecting vugs(?) faint outline of Cf. Girvanella(?) type algae.

11807-808 - Mudstone (Micrite-Sparite)
Matrix about 50% micrite, 50% neomorphic microspar. 10-15% Porosity mostly channel. Containing large burrow(?) now neomorphic spar (irregular distribution of crystal size), spar ranges in size around 1 mm. Styolitic - oil stained. Patches of Cf. Girvinella(?) algae.

11813-814 - Mudstone (Sparite)
Matrix about 10% micrite in scattered patches and neomorphic spar. 10-15% Porosity, channel and microvugular. Appears oomoldic(?) or some algal covered grain, around .14 mm diameter. Mullusk fragments; Ostracods(?); patches of Girvanella(?) algae, preserved in neomorphic microspar matrix. Few large (.75 mm) rhombs of dolomite infilling some of the pore spaces. Oil stained.

11818-819 - Mudstone (Sparite)
Matrix, neomorphic microspar-spar, after micrite(?). 5% Intraclast, odd shaped, oval Peloids(?) to rectangular micrite patches. 5% Porosity microvugular, with scalenohedral calcite infilling pore space. Oil stained pore throats. Very thin fractures some open, oil stained with very small scalenohedral calcite infill.

11820-821 - Mudstone (Micrite)
Matrix, 90% micrite with patches of neomorphic microspar. 5% Algal plates rectangular to oval shaped, very diffused. 5% Porosity with scalenohedral calcite infilling pore space. Oil stained. Styolitic dark brown to black tar(?) seams.

11826-827 - Mudstone (Micrite)
Matrix, 90% micrite with patches of neomorphic microspar. 2% Algal plates,rectangular to oval shaped, very diffused. 5-10% Porosity with scalenohedral calcite infilling pore space, microvugular to channel. Very slight oil stains.

11829-830 - Mudstone (Micrite)
Matrix about 80% micrite, 20% neomorphic microspar. 1% Algal plates, very diffused. 5-10% Porosity, microvugular. One individual Mullusk fragment, Pelecypod(?).

11835-836 - Mudstone (Micrite)
Matrix about 95% micrite with scattered patches of neomorphic microspar. 5-10% Porosity, microvugular to channel.

11838-839 - Mudstone (Micrite)
Matrix about 80% micrite, 20% neomorphic microspar. 5% Algal plaplates, rectangular to oval very diffused; approximately .6 mm x .4 mm. 5-10% Porosity, mostly channel with scalenohedral calcite infill, appear to be fabric selective in part; Intraclast(?) with large pore space or algal covered grain. Scattered Mullusk fragments now recrystallized. Ostracods(?). Oil stained.

11841-842 - Mudstone (Micrite)
Matrix; 60% micrite, 40% neomorphic. 5% Porosity oil stained pore throats, also two large vugs (approximately 4 mm x 8 mm). Very Styolitic - oil stained.

11850-851 - Wackestone (Sparite)
10% Algal covered grains, Intraclast(?). 40% Peloids, concentreated in large pocket of slide, burrow(?), probably fecal pellets, oval-round and rectangular, most with microspar veins or centers. Peloids make upless than 5% throughout rest of slide. 10% Porosity channel and microvugular, scalenohedral growth, some of the pore space have large dolomite crystals filling void space. Oil stained pore throats, scalenohedral calcite appears to have grown through the oil stained rim.

11854-855 - Mudstone (Sparite)
Matrix; neomorphic microspar (after micrite) and scattered patches of micrite. (Aggrading neomorphism) 2% Peloids(?) scattered patches of micrite, Intraclast(?). 1% Mullusk fragments. Scattered Ostracods(?).

11866-867 - Mudstone (Sparite)
Matrix composed of microspar-spar. 15-20% microvugular to channel Porosity, some interconnecting. Less than 5% Peloids(?) concentrated in small patches. Very slight oil stain.

micrite. (Aggrading neomorphism) 2% Peloids(?) scattered patches of micrite, Intraclast(?). 1% Mullusk fragments. Scattered Ostracods(?).

11866-867 - Mudstone (Sparite)
Matrix composed of microspar-spar. 15-20% microvugular to channel Porosity, some interconnecting. Less than 5% Peloids(?) concentrated in small patches. Very slight oil stain.

T1
11870-871 - Mudstone - (Micrite)
Matrix, 70-80% micrite, 20-30% microspar-spar. Less than 5% Peloids in scattered patches of micrite. Borings abundant. Dolomite filling some of pore space. Styolitic - heavy oil stain, dark black. Small fractures, some connected to pore space.

11873-874 - Mudstone-Wackestone (Sparite)
Matrix; even mix of micrite and microspar (aggrading neomorphism). 5-10% Peloids round to oval. Cf. Girvinella(?) species. 5-10% Porosity; microvugular to channel, scattered dolomite rhombs occluding porosity in part. Oil stained.

11876-877 - Mudstone (Micrite)
Matrix; 90% micrite, 10% neomorphic microspar in patches. (Aggrading neomorphism). Less than 5% Peloids very diffused small, .1 mm - .2 mm. 1-2% Porosity microvugular.

PETROGRAPHIC THIN-SECTION DESCRIPTIONS

HUNT OIL CO. INTERNATIONAL PAPER CO. PERMIT 746

Depth in Feet

12631-632 - Peloidal Wackestone-Packstone (Pelmicrite)
20% Peloids - well packed in part - very diffused edges. 5% Algal plates, most very diffused highly micritized(?). 1-2% Ostracod shells, most articulated. 1% Algal covered grain. Matrix: 70-80% micrite, 20-30% microspar - aggrading neomorphism(?).

12634-635 - Peloidal Packstone (Pelmicrite)
20-30% Peloids - probably pellets and forams; 10% forams milliolid species; 1-2% Intraclast; 5% Algal plates. Less than 1% porosity; Matrix, 95% micrite plus scattered microspar. Microstyolitic; oil stained.

12635-636 - Peloidal Packstone (Pelmicrite)
20-30% Peloids; 5-10% forams; 5% Mullusk fragments; scattered echinoid fragments; Matrix 60-70% micrite, 20-30% microspar. Less than 1% Porosity; Intraparticle porosity filled with large spar crystals filling Polecypod(?) mold.

12636-637 - Mudstone-Wackestone (Micrite)
Matrix, 90% micrite; 10% neomorphic microspar (after micrite). Peloids(?), very diffused, only recognizable as discrete masses in some parts of thin-section. Very styolitic, thin-section covered by braided styolitic seams, most dark brown-black oil stained(?). Peloids, better preserved within styolitic area. 1-2% Mullusk fragments.

12641-642 - Peloidal Packstone (Pelmicrite)
70% Peloids - round to oval, many of which

are probably forams. 5-10% Algal plates, rectangular to oval. 2-5% Mullusk fragments gastropods and pelecypods. Matrix 80% micrite with 10-20% neomorphic microspar. Porosity (none visible).

12642-643 - <u>Peloidal Packstone (Pelsparite)</u>
60-70% Peloids round to oval, many with internal structure possibly forams(?). 5-10% Algal plates rectangular to oval with channel-like striations running lengthwise. 1-3% Mullusk fragments. Matrix 70-80% microspar plus patches of micrite. Abundant algal covered grains. Porosity (none visible); it appears that both intraparticle and interparticle porosity is now occluded by spar; probably very little porosity was ever developed as interparticle, most appear to have been intraparticle (fabric-selective(?)) porosity now microspar-spar.

12644-645 - <u>Peloidal Packstone (Pelsparite)</u>
60-70% Peloids, very diffused in part - probably forams(?). Less than 2% Algal plates; 2-5% Ostracods or very small pelecypod shells, most unarticulated. Less than 2% echinoid fragments. Abundant algal covered grains. Porosity none visible. Oil stained(?), microstyolitic(?) in part.

12647-648 - <u>Peloidal Wackestone-Packstone (Pelmicrite)</u>
50% peloids, small oval to round; very diffused in some areas hard to differentiate from micrite matrix grumeleuse texture. 5% forams, some of the peloids are probably forams also. Less than 1% ostracods. Less than 1% mullusk fragments pelecypod(?). No visible porosity. Small patches of neomorphic microspar-spar 10% and 90% micrite. Slight oil stain.

12648-649 - <u>Wackestone (Micrite)</u>
5-7% peloids as above. Less than 1% algal plates decapod(?) fecal pellets. Less than 1% ostracods. No visible porosity. Micrite matrix. Thin-section cut too thin.

12650-651 - <u>Mudstone (Micrite)</u>
5-7% algal plates, decapod(?) fecal pellets. Less than 1% intraclast, peloids(?). Less than 1% ostracods(?), pelecypods(?). Very small thin inarticulated shells. No visible porosity. Styolitic dark brown to brown argillaceous(?) oil stained(?).

12653-654 - <u>Mudstone (Micrite)</u>
Less than 5% decapod(?) fecal pellets. Less than 1% ostracods(?), pelecypods(?). Very small thin inarticulated shells. No visible porosity. Styolitic dark brown to brown argillaceous stains. Grumeleuse texture.

12656-657 - <u>Wackestone-Mudstone (Micrite)</u>
5-7% algal plates (?), decapod(?) fecal pellets. Less than 1% ostracods(?). Thin inarticulated shells. Less than 2% peloids or very small intraclast (rounded to subrounded) irregularly shaped. No visible porosity. Matrix 95% micrite. Slight oil (?) stain. Tightly styolitic.

12659-660 - <u>Mudstone-Wackestone (Micrite)</u>
Approximately 10% peloids(?) or intraclast (?) very diffused. Less than 5% decapod(?) fecal pellets. Less than 1% mullusk fragments. Braided styolitic(?) seams much as (12636-637). Grumeleuse texture. Matrix 95% micrite. No visible porosity.

12660-661 - <u>Wackestone (Micrite)</u>
10% peloids(?) very diffused. Less than 2% decapod(?) fecal pellets. Less than 1% mullusk fragments. Less than 1% echinoderm fragments. Abundant algal covered grains. No visible porosity.

12662-663 - <u>Wackestone (Micrite)</u>
Less than 2% peloids. Approximately 5% mullusk fragments, single pelecypod(?) shells replaced by microspar 1% forams(?). Scattered echinoderm fragments. No visible porosity. Matrix 95% micrite, and some spar calcite.

12665-666 - <u>Mudstone (Micrite)</u>
Less than 2% peloids. Less than 1% forams 1% decapod(?) fecal pellets. 1% mullusk fragments scattered algal covered grains. Matrix 95% micrite. Sample highly micritized grumeleuse texture.

12667-668 - <u>Wackestone (Micrite)</u>
10% peloids, round to oval, 2% forams, some of peloids could be forams. 1% decapod(?) fecal pellets, very diffused. 1% mullusk fragments, pelecypods(?) small single shells. Matrix 95% micrite. No visible porosity.

12669-670 - <u>Oncolithic Packstone (Micrite)</u>
10-15% oncolites, algal covered grains. 2% ooids, over 3 lanunae. 2% decapod fecal pellets. Scattered peloids and forams. Slight oil stain.

12673-674 - <u>Peloidal Packstone (Pelmicrite)</u>
50% peloids, probably includes forams. 10% algal covered grains. 2% mullusk fragments, pelecypods(?) single shells. 5% ostracods articulated thin shells. Matrix 90% micrite, 10% spar replacing some shells and molds(?). No visible porosity. Intraparticle porosity plugged with spar. Styolitic, dark brown-brown, slight oil stain.

12678-679 - <u>Peloidal Packstone (Pelmicrite)</u>
50% peloids including forams and probably small intraclasts; very diffused. 5% decapod(?) fecal pellets. 1% mullusk fragments, pelecypods(?) single small shells. No visible porosity. Matrix 60% micrite, 40% microspar neomorphic after micrite.

12683-684 - <u>Peloidal Packstone-Wackestone (Pelmicrite-pelsparrite)</u>
40-50% peloids very diffused. 1% mullusk fragments scattered coralline red(?) algae. Matrix 50% micrite, 50% microspar neomorphic after micrite(?) large patches replaced by spar (2-3 mm). Algal bound grains. No visible porosity.

12684-685 - <u>Peloidal Packstone-Wackestone (Pelmicrite-pelsparite)</u>
40-50% peloids very diffused, highly micritized. Abundant algal covered grains, grapestone(?). Matrix 50% micrite, 50% microspar (neomorphic after micrite). Very thin-section.

12686-687 - <u>Peloidal Wackestone (Pelmicrite)</u>
30-40% peloids. Highly micritized. Approximately 1% forams, less than 5% decapod fecal pellets, abundant algal covered grains, echinoderm fragments. Styolitic oil stain.

12688-689 - <u>Wackestone (Micrite)</u>
20% peloids highly micritized, approximately 5% decapod fecal pellets, 1% mullusk fragments, pelecypods(?) abundant algal covered grains. Matrix 70-80% micrite and rest microspar, grumeleuse texture. No visible porosity.

12689-690 - <u>Mudstone (Micrite)</u>
Approximately 5% decapod fecal pellets, matrix very fine crystalline - micrite to microspar. 5% porosity.

12691-692 - <u>Mudstone (Micrite)</u>
Approximately 5% decapod fecal pellets, scattered algal bound grains. Matrix micrite to microspar, no visible porosity.

12692-693 - <u>Mudstone (Micrite)</u>
Approximately 5% decapod fecal pellets, 1% mullusk fragments (pelecypods), scattered algal covered grains. Matrix micrite to microspar. No visible porosity.

12694-695 - <u>Mudstone-Wackestone (Micrite)</u>
Approximately 10% decapod fecal pellets, 2-5% intraclast scattered algal covered grains. Matrix micrite with some microspar.

12695-696 - <u>Wackestone (Micrite)</u>
5-7% decapod fecal pellet fragments, 2% intraclasts(?). Approximately 5% peloids, scattered algal covered grains. Matrix micrite to microspar. Styolitic dark brown to brown, oil stained(?). No visible porosity.

12698-699 - <u>Mudstone-Wackestone (Micrite)</u>
5% decapod fecal pellets (some fragments), less than 5% peloids-intraclast. Trace echinoderm fragments, matrix micrite to microspar. Less than 1% porosity, microvug. Microsty olite; oil stained, short whisp-like dark brown seams.

12699-700 - <u>Wackestone (Micrite)</u>
10% peloids very highly micritized, diffused; less than 2% decapod fecal pellets. Matrix micrite with patches of microspar. Styolitic, oil stained.

12701-702 - <u>Wackestone-Packstone (Micrite)</u>
30-40% peloids, diffused; approximately 10% decapod fecal pellets; 5% forams (some of peloids above are probably forams), 1% echinoderm fragments; matrix micrite grumeleuse texture. No visible porosity.

12730-731 - <u>Wackestone (Micrite to sparite)</u>
Approximately 15% peloids, 5% decapod fecal pellets, scattered forams; matrix micrite to microspar. Small whispy styolitic-like seams.

12731-732 - <u>Wackestone (Micrite)</u>
15% peloids highly micritized; 5% decapod fecal pellets, 1% ostracods(?) sm. pelecypods. Oil stained in microstyolites very short. Matrix micrite to microspar, grumeleuse texture.

MOBIL OIL CORP.

#1 Florida State Lease 224A
Permit 387 Offshore Franklin County

13290-13300	Siltstone to sandstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine to fine grain. Moderate induration, slightly micaceous, very slightly fissile with 1-2% (clear-white N 9) coarse grain sandstone, trace gray siltstone. Approximately 2-5% porosity. In Haynesville.
13300-13310	Siltstone to sandstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine to fine grain. Moderate induration, slightly micaceous, very slightly fissile. Trace light green (greenish gray 5 G 6/1), fine grain sandstone.
13310-13320	Siltstone to sandstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine to fine grain. Moderate induration, slightly micaceous, very slightly fissile.
13320-13330	Siltstone to sandstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine to fine grain. Moderate induration, slightly micaceous, very slightly fissile. Slightly increasing (1-2%) medium grain sandstone. Trace gray siltstone.

13330-13340	Siltstone to sandstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine to fine grain. Moderate induration, slightly micaceous, very slightly fissile. Approximately 5% medium grain sandstone.
13340-13350	Siltstone to sandstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine to fine grain. Moderate induration, slightly micaceous, very slightly fissile, with green sandstone (greenish gray 5 G 6/1), fine grain, showing iron stain contact.
13350-13360	As above.
13360-13370	Siltstone to sandstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine to fine grain. Moderate induration, slightly micaceous, very slightly fissile. Trace (dusky brown 5 YR 2/2) to dusky (yellowish brown 10 YR 2/2) very fine crystalline limestone. Approximately 5% (clear to white N 9) medium grain sandstone.
13370-13380	Siltstone to sandstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine to fine grain. Moderate induration, slightly micaceous, very slightly fissile. Approximately 5% (clear to white N 9) medium to coarse grain. Sandstone, less than 1% gray siltstone, micaceous, fissile.
13380-13390	As above.
13390-13400	Siltstone to sandstone very dusky red (10 R. 2/2) to dark reddish brown (10 R 3/4) very fine to fine grain. Moderate induration, slightly micaceous, very slightly fissile. Approximately 1%

	gray siltstone. Gray siltstone starts to increase very slightly in this interval. Approximately 5% clear to white (N 9) medium to coarse grained sandstone.
13400-13410	Siltstone to sandstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine to fine grain. Moderate induration, slightly micaceous, very slightly fissile. Approximately 1-2% gray siltstone. Approximately 5% clear to white (N 9) medium to coarse grained sandstone.
13410-13420	As above with 5-7% medium to coarse grain sandstone clear to white (N 9) and approximately 2% gray siltstone. Coal? Plant material?
13420-13430	As above.
13430-13440	Sandstone to siltstone transparent to white (N 9) medium grain and sandstone to siltstone olive black (5 Y 2/1) very fine grain. Subrounded to sunangular, well sorted, weakly cemented, very slightly calcareous sandstone, glauconite? with 3-5% gray siltstone. Sandstone porosity approximately 10%. Plant material?
13440-13450	As above with less than 2% gray siltstone.
13450-13460	As above.
13460-13470	Sandstone to siltstone transparent to white (N 9) medium to coarse grain and sandstone to siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine grain. Subrounded to subangular, well sorted, weakly cemented, very slightly calcareous sandstone with 1% gray siltstone. 85% red sandstone and siltstone. <u>In Smackover</u>.

13470-13480	As above with increasing approximately 5% gray siltstone. 80% red sandstone and siltstone.
13480-13490	Siltstone to sandstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine to medium coarse grain. Moderate induration, fissile, very fine micaceous siltstone with sandstone as above. 75-80% red sandstone and siltstone.
13490-13500	Siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine grain. Moderate induration, fissile, very fine micaceous siltstone, decreasing in sandstone clear to white (N 9). Coal had pyrite seam? 75% red sandstone and siltstone.
13500-13510	As above with approximately 5-10% sandstone. 70% red sandstone and siltstone.
13510-13520	As above.
13520-13530	As above with approximately 5% sandstone.
13530-13540	As above with fine to medium grain greenish gray (5 G 6/1) sandstone as in core #1 P-957; less than 5% sandstone and a trace dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) limestone very fine crystalline dense.
13540-13550	As above with less than 2% sandstone. 80% red siltstone and sandstone.
13550-13560	As above with less than 1% sandstone.
13560-13570	As above with approximately 2% sandstone. 70-75% red sandstone and siltstone.
13570-13580	Siltstone and shale olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine grain. Moderate induration, fissile, very fine

micaceous siltstone. Less than 1% sandstone. 70% red sandstone and siltstone.

13580-13590 As above with a trace dusky brown (5 YR 2/2) to dusky yellowish brown (19 YR 2/2) limestone very fine crystalline dense. Less than 5 feet lag.

13590-13600 Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) micrite to very fine crystalline. Approximately 5% sandstone, dense. 70% red sandstone and siltstone.

13600-13610 As above.

13610-13620 Siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine grain. Moderate induration, very fine micaceous, slightly fissile. Approximately 2-3% limestone as above. 50% red sandstone and siltstone.

13620-13630 Siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine grain and sandstone greenish gray (5 GY 6/1) fine grain. Moderate induration, very fine micaceous, slightly fissile with fine grain, weakly cemented sandstone. Trace of limestone. 60% red sandstone and siltstone.

13630-13640 As above.

13640-13650 As above.

13650-13660 Siltstone olive gray (5 Y 4/1) very fine grain. Moderate induration, slightly micaceous (very fine) with sandstone as above. Trace of limestone. 40% red sandstone and siltstone.

13660-13670 As above.

13670-13680 Siltstone olive gray (5 Y 4/1) very fine grain and sandstone greenish gray (5 G 6/1) fine grain. Moderate induration, slightly micaceous (very fine), fissile with fine grain sandstone as in core #1 P-957. Less than 1% limestone. 40% red sandstone and siltstone.

13680-13690 As above with 5-10% clear to white (N 9) medium grain sandstone.

13690-13700 As above with a trace of limestone.

13700-13710 Siltstone olive gray (5 Y 4/1) to dark greenish gray (5 GY 4/1) very fine grain and limestone dusky brown (5 YR 2/2) to moderate orange pink (5 YR 8/4) micrite very fine crystalline. Moderate induration. Slightly micaceous (very fine), fissile. Increasing in limestone hard dense recrystalline? Approximately 25% red sandstone and siltstone.

13710-13720 Limestone dark yellowish brown (10 YR 4/2) to dusky brown (5 YR 2/2) to moderate yellowish brown (10 YR 5/4) and white (N 9) to very light gray (N 8) very fine grain to micrite. Calcilutite? Soft very fine grain containing dark argillaceous seams? with hard dense micritic limestone. Approximately 10 feet lag.

13720-13730 As above.

13730-13740 As above with lighter limestone dark yellowish brown (10 YR 4/2); appears to be thinly bedded with argillaceous material and/or dark limestone.

13740-13750 As above.

13750-13760 As above and some of the seams appear to be styolites.

13760-13770	Sandstone arkosic sands white (N 9) to moderate reddish orange (10 R 6/6) to moderate reddish brown (10 R 4/6) medium to coarse grain. Orange potash-feldspar with abundant coarse grain quartz. Top Norphlet 10-15 feet lag.
13770-13780	As above.
13780-13790	As above with mica. Approximately 80% gray.
13790-13800	As above.
13800-13810	As above decreasing in arkosic sands approximately 10%.
13810-13820	As above increasing in arkosic sands approximately 20-25%.
13820-13830	As above.
13830-13840	As above.
13840-13850	As above with some mica brotite?
13850-13860	As above with 50% gray siltstone.
13860-13870	As above, decreasing in arkosic sands. 70% gray siltstone. 5-10% red siltstone and sandstone.
13870-13880	Siltstone to sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine to fine to medium grain. Dark red siltstone to shale, very shiny in parts. Approximately 10% arkosic sands. 30% gray siltstone. 40-50% red siltstone and sandstone. Top Eagle Mills?
13880-13890	As above with less than 1% limestone and less than 1% arkosic sands. 20-30% gray siltstone. 60-70% red siltstone and sandstone.

13890-13900 As above with approximately 40% gray siltstone. 40% red siltstone and sandstone.

13900-13910 As above with 2-3% arkosix sands. 30-40% gray siltstone. 50-60% red siltstone and sandstone.

13910-13920 As above with approximately 2-3% calcilulite to calcarenite marked increase in gray siltstone. 70% gray siltstone. 20% red siltstone and sandstone.

13920-13930 Limestone dusky yellowish brown (10 YR 2/2) to white (N 9) to very light gray (N 8) very fine to fine crystalline. Approximately calcarenite to calcilutite; hard dense limestone dusky yellowish brown (10 YR 2/2) similar to limestone found in 13710-13720, soft weakly cemented. 40% gray siltstone. 40% red siltstone and sandstone.

13930-13940 As above.

13940-13950 Diabase black (N 1) microcrystalline. Aphanitic with pyrite with above. Diabase dyke or sill.

13950-13960 Diabase black (N 1) microcrystalline. Porphyritic in part. 13924 feet sonic.

13960-13970 Diabase black (N 1) micro crystalline. Porphyritic in part. Coarser than above. Differentiated sill?

13970-13980 As above. 40% red siltstone and sandstone. 15 feet lag.

13980-13990 Siltstone to sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine to fine grain. Medium induration, shiny in part with lighter red sandstone fine grain. 40% gray siltstone. 50% red siltstone and sandstone.

13990-14000 As above.

14000-14010 As above with increase in fine grain sandstone. 2-3% arkosic sands. 1-2% limestone dusky yellowish bronw (10 YR 2/2). 30-40% gray siltstone.

14010-14020 As above.

14020-14030 Diabase black (N 1) microcrystalline to fine grain. Porphyritic insipient metamorphism on siltstone, abundant mica in some chips.

14030-14040 Diabase black (N 1) microcrystalline to very fine grain. Porphyritic. Approximately 40% gray siltstone. 50% red siltstone and sandstone.

14040-14050 Siltstone to sandstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine to fine grain. Moderate induration, shiny in part; orange red sandstone. Approximately 40% gray siltstone. 50% red siltstone and sandstone.

14050-14060 As above with coarse grain quartz green in siltstone. 30-40% gray siltstone. 50-60% red siltstone and sandstone unconsolidated?

14060-14070 As above with 50% gray siltstone. 40% red siltstone and sandstone.

14070-14080 As above with 2% limestone dusky yellowish brown (10 YR 2/2). 1-2% diabase.

14080-14090 As above.

14090-14100 As above with less than 1% arkosic sands.

14100-14110	As above with less than 1% limestone dusky yellowish brown (10 YR 2/2), less than 1% diabase, less than 1% arkosic sands. 40% gray siltstone. 50-60% red siltstone and sandstone.
14110-14120	As above.
14120-14130	As above with 20-30% gray siltstone. 60-70% red siltstone and sandstone.
14130-14140	As above with approximately 1% arkosic sands. 20% gray siltstone. 70% red siltstone and sandstone.
14140-14150	As above with a trace of limestone and a trace of diabase. Approximately 1% arkosic sands. 30% gray siltstone. 60% red siltstone and sandstone.
14150-14150	As above with 20-30% gray siltstone. 60-70% red siltstone and sandstone.
14160-14170	As above with 10% gray siltstone. 85% red siltstone and sandstone.
14170-14180	As above.
14180-14190	As above with large calcite crystals embedded in fine grain siltstone. 5-10% gray siltstone. 85% red siltstone and sandstone.
14190-14200	As above.
14200-14210	As above with less than 5% gray siltstone.
14210-14220	As above with less than 1% diabase. Approximately 10% gray siltstone.
14220-14230	As above with approximately 1% diabase. Less than 5% gray siltstone. 90% red siltstone and sandstone.

14230-14240	As above.
14240-14250	As above.
14250-14260	As above.
14260-14270	As above.

<u>Core Descriptions</u>

14263½	Diabase black (N 1) fine grain. Quartz phonocryst. Large needle hornblende-tourmaline?
14264½	Diabase black (N 1) fine grain. Quartz phonocryst. Slightly calcareous.
14265½	As above.
14266½	As above.
14268½	As above.
14269½	As above.
14270½	As above.
14271½	As above.
14272½	As above.
14274½	As above.
14275½	As above.
14276½	Siltstone very dusky red (10 R 2/2) very fine grain. Well indurated, hard with rounded limestone dusky brown (5 YR 2/2) intraclasts.
14277½	As above.

End Core

14280-14290	Siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grain. Hard, well indurated. Approximately 1-2% diabase. Approximately 5% gray siltstone. 90% red siltstone and sandstone.
14290-14300	As above with calcareous crystallines embedded in siltstone. Approximately 1% limestone.
14300-14310	As above.
14310-14320	As above with approximately 1% limestone and approximately 1-2% diabase.
14320-14330	As above with approximately 1-2% arkosic sands potash-feldspar. 70% red siltstone and sandstone.
14330-14340	Diabase black (N 1) very fine grain to crystalline. Hard as in core. Approximately 15-20% gray siltstone. 70% red siltstone and sandstone.
14340-14350	As above.
14350-14360	As above.
14360-14370	Basalt Rhyolitic dusky brown (5 YR 2/2) to very dark red (10 R 2/2) aphanitic ground mass not able to determine rock type. Igneous Extrusive.

CHARTER EXPLORATION

St. Joe Paper #2
Permit 670 Gulf County

13900-13910	Siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine to fine grain, and sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) medium to coarse grain. Very slightly micaceous, slightly fissile and white (N 9) to translucent (5 R 6/2) medium to coarse grain and medium to coarse grain iron-stained sandstone. Sandstone has less than 10% porosity. 80% red sandstone and siltstone.
13910-13920	As above with less than 1% light greenish gray (5 G 8/1) slightly glauconite medium grain sandstone.
13920-13930	As above with less than 1% olive black (5 Y 2/1) very fine grain siltstone. Trace of plant material? Fist appearance of gray siltstone.
13930-13940	As above with a slight increase in olive black (5 Y 2/1) to olive gray (5 Y 4/1) very fine grain siltstone, poor induration (wet).
13940-13950	Siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine to fine grain. Poor induration, very slightly micaceous

(less than 5%), 10-15% sandstone as above. 80% red sandstone and siltstone. Smackover 13940' Sonic log.

13950-13960	Siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine to fine grain, and sandstone olive black (5 Y 2/1) fine to medium grain. As above with glauconite. Sandstone fine to medium grain. Plant material? 50% red sandstone and siltstone.
13960-13970	As above.
13970-13980	As above.
13980-13990	Siltstone and shale olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine to fine grain. Moderate induration, fissile, very slightly micaceous with less than 10% sandstone olive black (5 Y 2/1) fine grain. 40-50% red sandstone and siltstone.
13990-14000	As above.
14000-14010	As above.
14010-14020	As above with a trace of dusky yellowish brown (10 YR 2/2) limestone very fine crystalline; argillaceous. 30% red sandstone and siltstone.
14020-14030	Siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine to fine grain, and sandstone olive black (5 Y 2/1) fine grain. As above, with olive black (5 Y 2/1) sandstone very fine grain bedded, with plant remains, poorly indurated. Similar to sandstone in Core #1 (P-957).
14030-14040	As above with an increase in white (N 9) to clear sandstone (cavings?). 50% red sandstone and siltstone.

14040-14050	As above with a trace of limestone very fine crystalline (argillaceous?). 40% red sandstone and siltstone.
14050-14060	As above. 25% red sandstone and siltstone.
14060-14070	As above with abundant plant? material in olive black (5 Y 2/1) sandstone. 50% red sandstone and silstone.
14070-14080	Limestone dusky yellowish brown (10 YR 2/2) to moderate orange pink (5 YR 8/4) very fine crystalline to microspar, and siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine to fine grain. Very fine, hard, dense (less than 1%) with above.
14080-14090	Sandstone olive gray (5 Y 4/1) fine grain, and siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine grain. Sandstone is poorly indurated. Argillaceous (clay) with siltstone as above. 10% red sandstone and siltstone.
14090-14100	Sandstone olive gray (5 Y 4/1) to dark greenish gray (5 G 4/1) fine grain, and siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine grain. Siltstone and sandstone as in Core #1 (P-957). Thinly interbedded units? Trace of limestone (14070-80). 10% red sandstone and siltstone. Greenish tint on sandstone.
14100-14110	As above. Glauconite?
14110-14120	As above.
14120-14130	As above. Sandstone and siltstone ratios change.
14130-14140	As above.
14140-14150	As above.

14150-14160	As above with a trace of dusky yellowish brown (10 YR 2/2) very fine crystalline limestone - light brown calcareous sandstone less than 10% dissiminated plant material? in green sandstone. 10-15% red sandstone and siltstone.
14160-14170	As above. 5-10% red sandstone and siltstone.
14170-14180	As above.
14180-14190	As above.
14190-14200	As above.
14200-14210	No samples.
14210-14220	Siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine grain. Moderate induration, fissile, slightly micaceous. Approximately 10-15% red sandstone and siltstone.
14220-14230	As above with increase in limestone, hard, dense, very fine crystalline.
14230-14240	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine crystalline. Hard, dense, recrystallized? with above dolomitic? argillaceous.
14240-14250	As above, very thinly bedded limestone, argillaceous material, Algal mats?

Core Descriptions

14240-14244	Limestone dark gray (N 3) to black (N 1) and dusky yellowish brown (10 YR 2/2) microcrystalline very fine grain silty limestone contact with microcrystalline limestone tan to gray. Very tight.

14244-14245	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) microcrystalline. Dark gray microcrystalline - very thinly bedded? argillaceous material interbedded. Hard, well indurated. Very tight.
14245-14246	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) and black (N 1) to dark gray (N 3) microcrystalline. Very faint structures - contact with argillaceous silty limestone. Very tight.
14246-14247	As above with vugs filled with very fine grain to cryptocrystalline limestone, thinly bedded. Very tight.
14247-14248	As above with conchoidal fracturing. Thinly bedded (1 mm). Very tight.
14248-14249	As above.
14249-14250	As above.
14250-14251	As above.
14251-14252	As above with fissility.
12454-14253	As above.
14253-14254	Limestone dusky yellowish brown (10 YR 2/2) to dark gray (N 3) microcrystalline. Contact above with silty argillaceous limestone black (N 1) to dark gray (N 3). Very tight.
14254-14255	Limestone dusky yellowish brown (10 YR 2/2) to dark gray (N 3) microcrystalline. Thinly bedded as above with black brown - white crystals? on surface?
14255-14256	Limestone dusky yellowish brown (10 YR 2/2) to dusky brown (5 YR 2/2) micrite. Dark gray brown micrite crystalline thinly bedded. Dense.

14256-14257	As above.
14257-14258	As above.
14258-14259	As above (sample lag 5-6 feet).
14259-14259.5	Lithic tuffecious dusky yellowish brown (10 YR 2/2) to dusky brown (5 YR 2/2). Dark gray - tuffecious sediment composed of fragmented dacite, obsidian, limestone, and quartz (unsorted fine to medium grain rounded). Volcanic - some pieces exhibit rounding by water?
14259.5-14260	Dacite? Aphanitic. Light gray aphanitic ground mass with phenocrysts of feldspar, quartz with abundant pyrite, slightly calcareous.
14260-14260.5	Dacite? Porphiry, Aphanitic with phenocrysts. Dark gray ground mass with phenocrysts of quartz and potash-feldspar? (abundant).
14260.5-14261	As above with increase in potash-feldspar? covering most of sample, with quartz increasing with pyrite.
14261-14262	Reddish brown as above with bornite? abundant pyrite.
14262-14263	As above with decrease in phenocrystalline.
14263-14264	As above.
14264-14265	As above with green crystalline waxy soft minerals?
14265-14266	No sample.
14266-14267	As above with reddish brown to gray ground mass with abundant potash-feldspar? phenocryst.

14267-14268	As above.
14268-14269	As above.
14260-14270	As above.
14270-14271	As above with grayish-brown ground mass with abundant potash-feldspar? and quartz phenocryst.
14271-14272	As above.
14272-14273	As above.
14273-14274	As above.
14274-14275	As above.
14275-14276	As above.
14276-14277	As above.
14277-14278	As above.
14278-14279	As above.
14279-14280	As above with abundant green minerals as in (14265) (Chlorite? Serpentine?).
14280-14281	As above with reddish-brown ground mass with potash-feldspar? Quartz penocryst.
14281-14282	As above with reddish to slightly brown ground mass with potash-feldspar? Quartz phenocryst.
14282-14283	As above.
14283-14284	As above.
14284-14285	As above.
14285-14286	As above with abundant quartz.

14286-14287	As above.
14287-14288	As above.
14288-14289	As above.
14289-14290	As above.

PLACID OIL CO.

16-3 U.S.A.
Permit 745 Liberty County

11500-11510	Siltstone to sandstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine grain. Moderate induration, very slightly fissile, very finely micaceous and sandstone clear to dark reddish brown (10 R 3/4) medium grain, iron stained. Light green to clear to white (N 9) sandstone with iron stain.
11510-11520	Sandstone to siltstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4). Clear to iron-stained fine to very fine grain. Sandstone weakly indurated, calcareous cement in part, some chips show iron stain, with above.
11520-11530	Sandstone olive gray (5 Y 4/1) to dark greenish gray (5 GY 4/1) medium grain. Weakly indurated with very fine siltstone olive gray (5 Y 4/1) to dark greenish gray (5 GY 4/1) weakly indurated with plant? material. 80% red sandstone and siltstone. Top Sm2 (11515 feet). Sonic Log.
11530-11540	Sandstone clear to white (N 9) medium to fine grain. Moderate induration, calcareous cement approximately 10% sandstone well sorted? with tar-like material glauconite?, approximately 5% as above. Approximately 80-85% red siltstone.

11540-11550	Sandstone to siltstone clear to white (N 9) olive gray (5 Y 4/1) to dark greenish gray (5 GY 4/1) medium to very fine grain. Moderate induration, calcareous cement approximately 10% sandstone well sorted? with tar-like material glauconite? approximately 5% as above. Approximately 80-85% red siltstone.
11550-11560	Siltstone olive gray (5 Y 4/1) to dark greenish gray (5 GY 4/1) very fine grain. Weakly indurated, slightly fissile, very finely micaceous - decrease in sandstone as above.
11560-11570	Siltstone to sandstone olive gray (5 Y 4/1) to dark greenish gray (5 GY 4/1) very fine to fine grain. Weakly indurated, slightly fissile, very finely micaceous - interbedded with sandstone fine grain clear to white (N 9) glauconite? very slightly calcareous. 85% sandstone and siltstone.
11570-11580	As above.
11580-11590	As above.
11590-11600	As above.
11600-11610	Shale to siltstone to sandstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) pale yellowish green (10 GY 7/2) to dark greenish gray (5 GY 4/1). Siltstone very finely micaceous to sandstone as above. Sandstone is calcareous, shale very fissile breaks up with water. 70% red sandstone and siltstone.
11610-11620	Siltstone to sandstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) and dark greenish gray (5 GY 4/1) very fine to fine grain. Weakly indurated, very slightly fissile, very finely micaceous interbedded with fine grain sandstone-calcareous. 60% red sandstone and siltstone.

11620-11630	As above with a trace of limestone.
11630-11640	As above with chips showing contact of gray siltstone - clear to white (N 9) fine to medium grain sandstone. Plant? material. 60% red sandstone and siltstone.
11640-11650	Siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine grain. Weak induration, slightly fissile, very finely micaceous.
11650-11660	Siltstone to sandstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) and dark greenish gray (5 GY 4/1) very fine to fine grain. Siltstone as above with fine grain sandstone, very coarse micaceous, very soft - breaks up with water.
11660-11670	As above with a trace of limestone dusky yellowish brown (10 YR 2/2) to moderate yellowish brown (10 YR 5/4), hard, dense. 50% red sandstone and siltstone.
11670-11680	Siltstone to sandstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) and dark greenish gray (5 GY 4/1) very fine to fine grain. Moderate induration, very slightly fissile, very finely micaceous with fine grain glauconite? Sandstone calcareous very thinly bedded. Trace of limestone. 50% red sandstone and siltstone.
11680-11690	As above with a trace of limestone. Hard, dense crystalline dusky brown (5 YR 2/2) to dusky yellowish borwn (10 YR 2/2).
11690-11700	Siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) and sandstone dark greenish gray (5 GY 4/1) very fine grain. Moderate induration, very slightly fissile, very finely micaceous with sandstone as above calcareous.

11700-11710	As above with a trace of limestone: calcsiltite brownish gray (5 YR 4/1) and hard, dense crystalline dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2). 40% red sandstone and siltstone.
11710-11720	As above.
11720-11730	As above. No limestone.
11730-11740	As above. Mostly siltstone.
11740-11750	As above. Mostly siltstone with a trace of limestone hard, dense, dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) crystalline. 30% red sandstone and siltstone.
11750-11760	As above. 20% red sandstone and siltstone.
11760-11770	As above.
11770-11780	As above.
11780-11790	As above.
11790-11800	As above. 10% red sandstone and siltstone.
11800-11810	As above.
11810-11820	As above.
11820-11830	As above.
11830-11840	As above. Increase in sandstone with limestone hard, dense. Trace of calcsiltite brownish gray (5 YR 4/1).
11840-11850	As above.
11850-11860	As above.

11860-11870	As above. Less than 10% red sandstone and siltstone.
11870-11880	As above.
11880-11890	As above.
11890-11900	As above. Mostly siltstone.
11900-11910	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine crystalline. Hard, dense, with 90% as above. Plant? material. Less than 5% red sandstone and siltstone. <u>Top Sml?</u>
11910-11920	As above.
11920-11930	Limestone brownish gray (5 YR 4/1), dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) micrite to very fine crystalline. Hard, dense and calcsiltite soft to very fine dark microstyolite? Less than 40% as above. Less than 2% red sandstone and siltstone.
11930-11940	As above. Calcsiltite appears to be interbedded with olive gray (5 Y 4/1) to olive black (5 Y 2/1) siltstone. 15% red sandstone and siltstone.
11940-11950	Siltstone to limestone olive gray (5 Y 4/1) to olive black (5 Y 2/1) and brownish gray (5 YR 4/1), dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine grain to micrite to very fine crystalline. Moderate induration, very slightly fissile, very finely micaceous and limestone as above. 15% red sandstone and siltstone.
11950-11960	As above. Decrease in limestone (less than 10%). Less than 5% red sandstone and siltstone.

11960-11970	Siltstone to sandstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) and dark greenish gray (5 GY 4/1) very fine to fine grain. As above increasing in sandstone. Less than 1% limestone as above. Plant? material.
11970-11980	As above.
11980-11990	Arkosic sands moderate reddish brown (10 R 4/6) to clear medium to coarse grain. Very fresh potash-feldspar to quartz Chlorite-biotite (minor) with 25% as above. With chert. <u>In Norphlet</u>.
11990-12000	As above with 30% as above, with chert. Plant? material.
12000-12010	Siltstone to sandstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) and dark greenish gray (5 GY 4/1) very fine grain. Moderate induration, very slightly fissile, very finely micaceous. Less than 1% arkosic sands. Trace of limestone.
12010-12020	As above. Less than 10% red sandstone and siltstone.
12020-12030	As above with dusky yellowish brown (10 YR 2/2) to dusky brown (5 YR 2/2) limestone hard, dense and brownish gray (5 YR 4/1) calcsiltite with microstyolite? Less than 10% red sandstone and siltstone.
12030-12040	As above. Some chips show gray siltstone to blackish red (5 R 2/2) to very dusky red (10 R 2/2) siltstone contact. 10-15% red sandstone and siltstone.
12040-12050	As above with limestone as (12030).
12050-12060	Siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1), blackish red (5 R 2/2) to very dusky red (10 R 2/2) very fine grain.

	Hard, moderate induration - siltstone as above with red siltstone. Trace of anhydrite. 25% red sandstone and siltstone. 20 feet lag. In Louann.
12060-12070	As above.
12070-12080	Anhydrite white (N 9) very fine grain. Soft with siltstone as above (95%).
12080-12090	As above with hard, dense crystalline dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) limestone.
12090-12100	As above.
12100-12110	As above.
12110-12120	As above.
12120-12130	Silstone blackish red (5 R 2/2) to very dusky red (10 R 2/2) and olive gray (5 Y 4/1) very fine grain. Hard, moderate induration, very finely micaceous, slightly fissile with gray siltstone. In Eagle Mills, 20 feet lag.
12130-12140	Diabase? and siltstone fine to coarse grain. Green to red to black, coarse grain mafic igneous. Some appear to have red siltstone fragment inclusions. Approximately 90% siltstone as above. Trace of anhydrite.
12140-12150	As above.
12150-12157	As above.
12157-12170	Siltstone blackish red (5 R 2/2) to very dusky red (10 R 2/2) and olive gray)5 Y 4/1). (12130) with approximately 2% diabase? as above.

12170-12180	Siltstone blackish red (5 R 2/2) to very dusky red (10 R 2/2) very fine grain, and diabase olive gray (5 Y 4/1) fine to coarse grain. Lithology as above.
12180-12190	As above.
12190-12200	As above.
12200-12210	As above.
12210-12220	As above.
12220-12230	As above.
12230-12240	Diabase white (N 9) to dark greenish gray (5 GY 4/1) to black (N 1) fine to coarse grain and siltstone very fine grain. As above with abundant red increasing in diabase (country rock?).
12240-12250	As above.
12250-12260	As above. Diabase 70%.
12260-12270	As above. Diabase 80%.
12270-12280	As above.
12280-12290	Granite white (N 9) to moderate pink (5 R 7/4) fine to coarse grain. Potash-feldspar? white feldspar and quartz. Very fine accessory mineral chlorite? and black mineral felsic.
12290-12300	As above.
12300-12310	As above.
12310-12320	As above with increase in accessory mineral percentage. Also coarser chlorite - and black mineral felsic.

12320-12330	As above.
12330-12340	As above.
12340-12350	As above with an increase in potash-feldspar (orange).
12350-12360	As above.
12360-12370	As above.
12370-12380	As above.
12380-12390	As above.
12390-12400	As above.

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12280-12300	Sandstone fine to coarse grain and siltstone dark reddish brown (10 R 3/4) very fine grain. Red silty shale, very micaceous, some fissility, hard dense quartz sandstone medium to coarse grain, angular, some calcareous cement. Shale and sandstone interbedded. Some gray micaceous shale and quartz clear to gray. Less than 1% gray. Weathered (arkosic sands).
12300-12320	Sandstone dark reddish brown (10 R 3/4) and siltstone very dusky red (10 R 2/2) medium to coarse grain. As above with a slight increase in sandstone and brown (very dusky red 10 R 2/2 shale, very micaceous) large quartz grains. Less than 1% gray. Sandstone 10-20%.
12320-12330	As above with sand becoming coarser. Some large flat 2-3 mm long.
12330-12340	Sandstone dark reddish brown (10 R 3/4) and siltstone very dusky red (10 R 2/2) coarse to medium grain. Clear to white iron-stained. Coarse grain quartz sandstone with above, and 1% light green siltstone? Less than 1% gray.
12340-12350	As above. Some of the coarse grain sand are well rounded and flat around 2-3 mm. Less than 1% gray. Stream deposited?

12350-12370	Sandstone dark reddish brown (10 R 3/4) medium to coarse grain and siltstone very dusky red (10 R 2/2) very fine grain. Red siltstone and shale and sandstone (12,280 to 12,290). Less than 1% gray.
12370-12380	Sandstone and siltstone dark reddish brown (10 R 3/4) medium to coarse grain. Sandstone interbedded with silty shale - increase in sandstone.
12380-12410	Siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grain, and sandstone clear medium to coarse grain. As above; ratio change. Siltstone varies to shale with fissility with brown argillaceous material very micaceous shale. Soft quartz sand abundant with white quartz angular.
12410-12420	Sandstone clear medium to very coarse grain and siltstone and shale dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grain. Clear to white (N 9) quartz angular coarse to medium grain. Medium grain quartz cement some with silica with sparse calcite, gray fine grain shaly streaks of dark quartz. Lithology change.
12420-12470	Siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) and sandstone clear to white (N 9) medium to coarse grain. As above with more siltstone and shale than sandstone.
12470-12490	As above with light gray shale, very soft, slightly calcareous, very angular. Slight increase in gray siltstone.
12490-12500	Siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grain and sandstone clear to dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2).

As above with large pebble size quartz - fine to medium grain calcareous sandstone, light tan color. Slight increase in gray siltstone. Plant? material.

12500-12510 Sandstone black (N 1) to dark gray (N 3) very fine to fine grain, and siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grain. Well sorted with above. Very fine porosity 10-15%. Plant? material. 90% red sandstone and siltstone. Lithology change, Haynesville?

12510-12520 Limestone dark yellowish brown (10 YR 4/2) to brownish gray (5 YR 4/1) very fine crystalline. Hard, good induration, probably microspar with red sandstone to siltstone as above. Dense. 85% red sandstone and siltstone.

12520-12530 Limestone dark yellowish brown (10 YR 4/2) to brownish gray (5 YR 4/1) very fine grain. Oolitic-bimodal? Wackestone to packstone. Some oolites are oval and hard dense microspar? Dense. 30% red sandstone and siltstone.

12530-12540 As above. Some chalky limestone.

12540-12550 As above. Plant? material and coal. 20% red sandstone and siltstone.

12550-12560 As above. Trace of pyrite. 2-3% grayish olive green (5 GY 3/2) shale.

12560-12570 Shale, siltstone and sandstone black (N 1) very fine grain. Poor induration, very fissile, slightly micaceous with unconsolidated to poorly indurated dark gray (N 3) sandstone, some very calcareous. Loose sand and approximately 10% limestone as above. Shale 10-25%. Plant? material and coal. 30% red sandstone and siltstone.

12570-12580	As above.
12580-12590	As above.
12590-12600	Sandstone fine grain and siltstone very fine grain dark gray (N 3) to dusky yellowish brown (10 YR 2/2). Well sorted, moderate induration, slightly calcareous and very calcareous sandstone? very argillaceous with limestone as above (less than 10%). 30% red sandstone and siltstone.
12600-12610	As above with a decrease in limestone (less than 7%). 35% red sandstone and siltstone.
12610-12620	As above with a decrease in limestone (less than 5%). Trace of plant? material. 30% red sandstone and siltstone. Fossil fragments?
12620-12630	As above. 50% red sandstone and siltstone.

<u>Core Descriptions</u>

12628-12629	Thin-section. Described in appendix.
12629-12630	Limestone dark yellowish brown (10 YR 4/2) very fine micrite. Well indurated, contact with dark gray (N 3) siltstone to shale layer. Could be peloidal? Small wisp of tar? Mudstone.
12630-12631	Thin-section.
12631-12632	Thin-section.
12632-12633	Limestone dark yellowish brown (10 YR 4/2) very fine micrite. Well indurated, peloidal? Looks lumpy. Dense. Mudstone to Wackestone.
12633-12634	Thin-section.
12634-12635	Thin-section.

12635-12636	Thin-section.
12636-12637	Thin-section.
12637-12638	Limestone dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1) very fine to micrite. Recrystalline? Probably peloidal, looks lumpy. Microspar? Dense. Wackestone?
12638-12639	Limestone dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1) micrite to fine grain. Spar infilling voids? Peloidal? Dense. Wackestone?
12639-12640	Thin-section.
12640-12641	Limestone dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1) micrite to fine grain. Spar peloidal fragments? and vugulars? Peloidal? Dense. Wackestone?
12642-12643	Thin-section.
12643-12644	Limestone dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1) micrite to fine grain. Peloidal? Streak of dark gray (N 3) silty argillaceous layer with plant? remains. Styolite? Dense. Wackestone?
12644-12645	Limestone dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1) micrite. Peloidal? with styolitic seams infilled with dary gray (N 3) argillaceous material. Dense. Wackestone?
12645-12646	Limestone dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1) micrite. Peloidal? recrystalline? Dense. Wackestone?
12646-12647	Thin-section.
12647-12648	Thin-section.

12648-12649 Thin-section.

12649-12650 Limestone pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2) micrite to microspar. Peloidal? recrystalline? Dense. Tar? Wackestone?

12650-12651 Thin-section.

12651-12652 Limestone pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2) micrite to microspar. Styolite seam. Peloidal? Wackestone?

12652-12653 Limestone pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2) micrite to microspar. Peloidal recrystalline? Wackestone?

12653-12654 Thin-section.

12654-12655 Limestone pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2) micrite to microspar. Lumpy peloidal? Dense. Wackestone?

12655-12656 As above with styolite seam. Infilled argillaceous.

12656-12657 Thin-section.

12657-12658 Limestone pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2) micrite to microspar. Lumpy peloidal? Dense. Wackestone?

12658-12659 Limestone dark yellowish brown (10 YR 4/2) to dusky yellowish brown (10 YR 2/2) micrite to microspar. Lumpy peloidal? Dense. Wackestone?

12659-12660 Thin-section.

12660-12661 Thin-section.

12661-12662	Limestone dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1) micrite. Hard. Dense. Mudstone?
12662-12663	Thin-section.
12663-12664	Limestone olive gray (5 Y 4/1) to dark yellowish brown (10 YR 4/2) micrite. Hard. Dense. Tar. Mudstone.
12664-12665	Limestone dark yellowish brown (10 YR 4/2) to dusky yellowish brown (10 YR 2/2) Hard. Dense. Mudstone.
12665-12666	Thin-section.
12666-12667	Limestone dark yellowish brown (10 YR 4/2) to dusky yellowish brown (10 YR 2/2). Hard. Dense. Mudstone.
12667-12668	Thin-section.
12670-12671	Limestone pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2) micrite to microspar. Granular looking peloid? Approximately 5-7% porosity. Granite?
12671-12672	As above.
12672-12673	As above.
12673-12674	Thin-section.
12674-12675	Limestone dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1) very fine grain to micrite. Hard. Peloid? Recrystalline? Dense.
12675-12676	As above.
12676-12677	As above with plant? remains. Tar?
12677-12678	As above.

12678-12679	Thin-section.
12679-12680	Thin-section.
12680-12681	Thin-section.
12681-12683	Thin-section.
12683-12684	Thin-section.
12684-12685	Thin-section.
12685-12686	Limestone dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1) very fine grain to micrite. Hard. Recrystalline? Spar infilling. Dense.
12686-12687	Thin-section.
12687-12688	Limestone dusky yellowish brown (10 YR 2/2) to dark yellowish brown (10 YR 4/2). Hard. Recrystalline? Lumpy Peloidal? Dense.
12688-12689	Thin-section.
12689-12690	Thin-section.
12690-12691	Limestone pale yellowish brown (10 YR 6/2) micrite to fine grain. Hard. Not recrystalline? 3-5% porosity. Mudstone.
12691-12692	Thin-section.
12692-12693	Thin-section.
12693-12694	Limestone dark yellowish brown (10 YR 4/2) to pale yellowish brown (10 YR 6/2) very fine grain to micrite. Peloidal? Not recrystalline? 5-7% porosity.
12694-12695	Thin-section.
12695-12696	Thin-section.

12696-12697 Limestone dark yellowish brown (10 YR 4/2) to dusky yellowish brown (10 YR 2/2) very fine grain to microspar. Hard lumpy. Peloids? Dense. Wackestone?

12697-12698 Limestone dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1). Lithology as above.

12698-12699 Thin-section.

12700-12701 Limestone dark yellowish brown (10 YR 4/2) to olive gray (5 Y 4/1) very fine grain to micrite. Hard lumpy peloids?

12701-12702 Thin-section.

12702-12703 Limestone pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2) micrite. Hard. Not recrystalline. Dense.

<u>End Core</u>

12700-12710 Limestone pale yellowish brown (10 YR 6/2) to dusky yellowish brown (10 YR 2/2) micrite to fine grain. Hard crystalline recrystalline? microvugular porosity and dnese dark yellowish brown (10 YR 4/2) to dusky yellowish brown (10 YR 2/2) limestone with dark gray siltstone and red sandstone to siltstone. 10-15% porosity.

12710-12720 Limestone pale yellowish brown (10 YR 6/2) to dusky yellowish brown (10 YR 2/2) micrite to fine grain, and siltstone dark gray (N 3) very fine grain. Hard dense recrystalline? and microvugular porosity with dark gray (N 3) well indurated siltstone and red sandstone to siltstone. 10-15% porosity.

12720-12730 Limestone pale yellowish brown (10 YR 6/2) to dark yellowish brown (10 YR 4/2) very fine to fine grain. Crystalline recrystalline, microvugular porosity. Peloid?

dark gray (N 3) siltstone and red sandstone to siltstone. 10-15% porosity.

12730-12740	Limestone pale yellowish brown (10 YR 6/2) to dusky yellowish brown (10 YR 2/2) micrite to very fine grain. Limestone as above with abundant very hard dense recrystalline peloid? dense to 10% porosity.
12740-12750	As above.

<u>Core Descriptions</u>

12730-12731	Thin-section.
12731-12732	Thin-section.
12732-12733	Limestone dark yellowish brown (10 YR 4/2) to dusky yellowish brown (10 YR 2/2) micrite to very fine grain. Hard lumpy probably peloids? recrystalline? Dense.
12733-12734	Sandstone medium gray (N 5) to medium bluish gray (5 B 5/1) fine to coarse grain. Congomerate quartz and granite wash (potash-feldspar) glauconite, calcareous, unsorted. 15-25% porosity. <u>Top Norhplet</u>.
12734-12735	Sandstone medium gray (N 5) to medium bluish gray (5 B 5/1) conglomeratic. As above, feldspar looks very fresh. 15-25% porosity.
12735-12736	Sandstone medium dark gray (N 4) to brownish gray (5 YR 4/1) conglomeratic. Lithology as above, biotite.
12736-12737	As above.
12737-12738	As above with large fragmented arkosic sands. Stained? very feldspar orange. 15-25% porosity. Argillaceous.

12738-12739	As above with large fragmented arkosic sands. 15-25% porosity.
12739-12740	Thin-section.

<u>End Core</u>

12740-12750	Described on last page before care. The samples show limestone but must not be adjusted for lag. Approximately 10-20 feet.
12750-12760	Sandstone medium dary gray (N 4) to brownish gray (5 YR 4/1) conglomeratic. Potash-feldspar as in core: very little sampel.
12760-12770	As above. Potash-feldspar increases, abundant cavings.
12770-12780	Sandstone medium dark gray (N 4) to dark reddish brown (10 R 3/4). As above, abundant cavings, abundant lost material.
12780-12790	As above.
12790-12800	Sandstone and siltstone dark reddish brown (10 R 3/4) to very dark red (5 R 2/6) fine to medium grain. Moderate and less than 1% arkosic sands. 5-7% porosity.
12800-12810	As above.
12820-12830	Sandstone clear to dark reddish brown (10 R 3/4) to very dark red (5 R 2/6) fine to medium grain. As above with siltstone dark reddish brown (10 R 3/4). 10-12% porosity.
12830-12840	Sandstone and siltstone clear to dark reddish brown (10 R 3/4) to very dark red (5 R 2/6) fine to medium grain. As above with increasing siltstone.

12840-12850	Siltstone dark reddish brown (10 R 3/4) to very dark red (5 R 2/6) very fine to fine grain. Moderate induration, slightly fissile with sandstone as above dark reddish brown (10 R 3/4) slightly micaceous.
12850-12860	As above.
12860-12670	As above.
12870-12880	Siltstone dark reddish brown (10 R 3/4) to very dark red (5 R 6/2) very fine to fine grain. Slightly fissile, slightly micaceous dark reddish brown (10 R 3/4) with sandstone as above. Less than 1% potash-feldspar. Dense.
12880-12890	As above.
12890-12900	Arkosic sands clear to white (N 9) to orange coarse grain. Orange potash-feldspar with milky white quartz and scattered brotite?
12900-12910	As above.
12910-12929	As above with increasing orange.
12920-12930	As above.
12930-12970	As above.
12970-12980	As above with an increase in quartz white (N 9).
12980-13070	Granite clear to white (N 9) to orange coarse grain.

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13850-13860	Siltstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine grain. Slightly micaceous siltstone to shale, slightly fissile with 5% sandstone fine to medium grain, slightly calcareous and less than 1% arkosic sands. 90% red sandstone and siltstone.
13860-13870	Siltstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine grain, and sandstone transparent (5 R 8/2) to translucent (5 R 6/2) to dark reddish brown (10 R 3/4) fine to medium grain. Siltstone as above; increasing 7-8% sandstone. Trace of chert. Less than 1% arkosic sands. 90% red sandstone and siltstone. Light green siltstone to sandstone showing iron-stain contact.
13870-13880	Sandstone transparent (5 R 8/2) to translucent (5 R 6/2) to dark reddish brown (10 R 3/4) fine to medium grain, and siltstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine grain. Siltstone as above; 10-15% sandstone with less than 1% green sandstone; less than 1% black (N 1) siltstone. Trace of plant remains? 85% red sandstone and siltstone.

13880-13890	Sandstone clear to dark reddish brown (10 R 3/4) fine to coarse grain, and siltstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine grain. As above; slightly increasing (less than 1%) black (N 1) siltstone; 15-20% sandstone. 80% red sandstone and siltstone.
13890-13900	Siltstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine grain. Siltstone as above with 2-3% sandstone. Trace of black (N 1) siltstone. Trace of green sandstone. 95% red sandstone and siltstone.
13900-13910	Siltstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) and sandstone clear to dark reddish brown (10 R 3/4) very fine grain. As above with 10% sandstone, less than 1% black (N 1) siltstone, less than 1% green sandstone. 95% red sandstone and siltstone.
13910-13920	Siltstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine grain, and sandstone clear to dark reddish brown (10 R 3/4) fine to coarse grain. As above with 10-15% sandstone. 90% red sandstone and siltstone.
13920-13930	Sandstone clear to dark reddish brown (10 R 3/4) to white (N 9) fine to coarse grain. 20-25% sandstone, increasing in black (N 9) and olive black (5 Y 2/1) siltstone approximately 5%. 10-15% porosity. Plant? remains. 85% red sandstone and siltstone.
13930-13940	As above with 25-30% sandstone (10-15% arkosic sands? feldspar to sandstone). Approximately 1% black (N 1) and olive black (5 Y 2/1) siltstone. Less than 1% plant-coal.

10-15% porosity. 80% red sandstone and siltstone.

13940-13950	As above with 1-3% black (N 1) and olive black (5 Y 2/1) siltstone. 10-15% porosity. 80% red sandstone and siltstone.
13950-13960	Siltstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine grain, and sandstone clear to dark reddish brown (10 R 3/4) to white (N 9) fine to coarse grain. Sandstone as above with an increase in siltstone. Trace of limestone. Plant remains? 90% red sandstone and siltstone.
13960-13970	As above.
13970-13980	As above with a trace of green sandstone; trace of limestone. Less than 1% black (N 1) and olive black (5 Y 2/1) siltstone.
13980-13990	As above with 2-3% black (N 1) and olive black (5 Y 2/1) siltstone. 90% red sandstone and siltstone.
13990-14000	Siltstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) and black (N 1) and olive black (5 Y 2/1) very fine grain. As above with an increase in black (N 1) and olive black (5 Y 2/1) siltstone 5%. 85% red sandstone and siltstone.
14000-14010	Siltstone black (N 1) and olive black (5 Y 2/1) very fine grain, moderate induration with plant remains? Abundant (70%) cavings? 5-10% sandstone as above. 75% red sandstone and siltstone.
14010-14020	As above.
14020-14030	Siltstone black (N 1) to olive black (5 Y 2/1) very fine grain. Moderate conglomerate, very finely micaceous;

approximately 10% sandstone dark reddish brown (10 R 3/4) to white (N 9) to clear, with red siltstone as above. Trace of plant remains? 75% red sandstone and siltstone.

14030-14040	As above (10-15%), 10% sandstone as above.
14040-14050	As above (25%), 10% sandstone as above. Less than 1% silty limestone medium dark gray (N 4). 70% red sandstone and siltstone.
14050-14060	As above (30%). Trace of limestone dusky yellowish brown (10 YR 2/2). Trace of coal?
14060-14070	As above.
14070-14080	As above (40%), 1-3% olive black (5 Y 2/1) silty very argillaceous limestone and dusky brown (5 YR 2/2) limestone dense crystalline. 50% red sandstone and siltstone.
14080-14090	As above (50%).
14090-14100	As above (60%), 1-3% olive black (5 Y 2/1) very argillaceous silty limestone and dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) limestone dense, crystalline. 40-50% red sandstone and siltstone.
14100-14110	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine crystalline. Very dense, well indurated (10%), with 40-60% siltstone as above. 25-30% red sandstone and siltstone.
14110-14120	As above (15%). 5% red sandstone and siltstone.
14120-14130	Siltstone black (N 1) to olive black (5 Y 2/1) very fine grain. Siltstone as above with 5-7% limestone as above. 7-10% red sandstone and siltstone.

14130-14140	As above with 2-3% limestone as above. 10% red sandstone and siltstone.
14140-14150	As above with a trace of limestone. Light greenish gray fine grain sandstone as in core of P-957. 5% red sandstone and siltstone.
14150-14160	Limestone dark gray (N 3) very fine to crystalline. Silty argillaceous limestone with 15-20% dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very dense limestone crystalline with above material. 5% red sandstone and siltstone.
14160-14170	As above.
14170-14180	Siltstone black (N 1) to olive black (5 Y 2/1) very fine grain. Moderate induration, very finely micaceous with limestone as above. 15% red sandstone and siltstone.
14180-14190	Siltstone and sandstone black (N 1) to olive black (5 Y 2/1) very fine grain. As above with fine grain olive black (5 Y 2/1) sandstone. Moderate induration.
14190-14200	Sandstone olive black (5 Y 2/1) fine grain, and siltstone black (N 1) to olive black (5 Y 2/1) very fine grain. Interbedded siltstone and sandstone. 20% red sandstone and siltstone.
14200-14210	As above. 15% red sandstone and siltstone.
14210-14220	As above with moderately indurated sandstone, very slightly calcareous (60%). 10% red sandstone and siltstone.
14220-14230	As above. 20% red sandstone and siltstone.
14230-14240	As above. 25% red sandstone and siltstone.

14240-14250	As above. 20% red sandstone and siltstone.
14250-14260	As above with less than 1% dusky brown (5 YR 2/2) and dusky yellowish brown (10 YR 2/2) dense limestone crystalline. 15% red sandstone and siltstone.
14260-14270	Siltstone black (N 1) to olive black (5 Y 2/1) very fine grain. Moderate induration, slightly fissile, slightly micaceous very fine. Less than 1% limestone as above. 10% red sandstone and siltstone.
14270-14280	Siltstone olive black (5 Y 2/1) very fine grain and sandstone black (N 1) to olive black (5 Y 2/1) fine grain. As above (14,260). 10% red sandstone and siltstone.
14280-14290	Sandstone black (N 1) to olive black (5 Y 2/1) fine grain and siltstone and shale olive black (5 Y 2/1) very fine grain. As above. 5-7% red sandstone and siltstone.
14290-14300	As above. Trace of limestone dusky brown (5 YR 2/2) and dusky yellowish brown (10 YR 2/2) dense crystalline. 5-7% red sandstone and siltstone.
14300-14310	As above. 15% red sandstone and siltstone.
14310-14320	Limestone dusky yellowish brown (10 YR 2/2) to black (N 1) microspar very fine crystalline. Hard to microspar? Slightly argillaceous layer. Very thinly bedded. Algal material? Upon etching, some chips leave a high relief argillaceous. Dense. 5% red sandstone and siltstone. Lithology change.
14320-14330	As above.

Core Descriptions

14330-14333	Shale and limestone dark gray (N 3) to black (N 1). Calcareous shale, very fissile micrite. Dense.
14333-14334	As above with dark gray (N 3) limestone thinly bedded.
14334-14337	Shale dark gray (N 3) to black (N 1), slightly calcareous shale very fissile, slightly micaceous.
14337-14338	As 14333-14334.
14338-14339	As 14334-14337.
14339-14341	Limestone micrite dark gray (N 3) to brown micrite. No fossils.
14341-14345	Shale dark gray (N 3), slightly calcareous shale, micaceous.
14345-14348	Shale as above with abundant inclusions of plant remains?
14348-14350	Limestone dark gray (N 3) to brown slightly shaly limestone with large calcite inclusions.
14350-14352	Shale dark gray (N 3) very slightly calcareous shale, very fissile.
14352-14353	As above with very abundant mica.
14353-14354	Shale and limestone. Dark gray (N 3) shale interbedded with thin 8-10 mm silty limestone.
14354-14355	As 14352-14353.
14355-14361	Shale dark gray (N 3) very slightly calcareous shale, fissile, slight mica.

14361-14362	As above with an increase in mica.
14362-14364	As 14355-14361.
14364-14368	Shale very micaceous.
14368-14371	Shale light gray (N 7) silty shale, slightly calcareous, very micaceous.
14371-14373	Sandstone light gray (N 7) very calcareous sandstone fine grain calcareous cement, very micaceous.
14373-14375	As above with decreasing calcareous.

<u>End Core</u>

14370-14380	Siltstone and shale olive black (5 Y 2/1) very fine grain. Moderate induration, slightly fissile, very slightly micaceous with olive black (5 Y 2/1) sandstone interbedded. Approximately 10% limestone. 5-7% red sandstone and siltstone.
14380-14390	As above.
14390-14400	Limestone dusky yellowish brown (10 YR 2/2) to black (N 1) and siltstone black (N 1) to olive black (5 Y 2/1). Limestone as 14320 with above. 5% red sandstone and siltstone.
14400-14407	Siltstone black (N 1) to olive black (5 Y 2/1) and limestone dusky yellowish brown (10 YR 2/2) to black (N 1). As above. 10% red sandstone and siltstone.
14407-14410	Siltstone black (N 1) to olive black (5 Y 2/1) very fine grain. Moderate induration, slightly fissile, very slightly micaceous with olive black (5 Y 2/1) sandstone interbedded. Approximately 5% limestone. Plant remains?

14410-14420	Siltstone and shale black (N 1) to olive black (5 Y 2/1) very fine grain. Moderate induration, very slightly micaceous, slightly fissile with 10% limestone as above. 5-7% red sandstone and siltstone.
14420-14430	As above. 10% red sandstone and siltstone. Plant remains?
14430-14440	Limestone dusky yellowish brown (10 YR 2/2) to dusky brown (5 YR 2/2) microspar to very fine crystalline, and siltstone black (N 1) to olive black (5 Y 2/1) very fine grain. Siltstone as above with hard, dense limestone. 5-7% red sandstone and siltstone.
14440-14450	Limestone dusky yellowish brown (10 YR 2/2) to dusky brown (5 YR 2/2) very fine to microspar. Hard, well indurated with fine, thin layers of argillaceous material. Trace of pyrite. Dense. 5% red sandstone and siltstone.
14450-14460	Limestone dusky yellowish brown (10 YR 2/2) to dusky brown (5 YR 2/2) very fine to microspar. Limestone as above and very fine grain dusky yellowish brown (10 YR 2/2) limestone. Not as dense as above. Very fine porosity? Sucrosic? Interbedded. 1-2% red sandstone and siltstone.
14460-14470	As above. 19 mm chip with 16 layers of algal material? Spar vein through it. Plant remains?
14470-14480	As above. Many healed fractures? on dark, dense limestone with white (N 9) spar.
14480-14490	As above. Approximately 60-70% dusky yellowish brown (10 YR 2/2) limestone.
14490-14500	As above.
14500-14510	As above.

14510-14520	Limestone dusky yellowish brown (10 YR 2/2) to dusky brown (5 YR 2/2) very fine to microspar, and siltstone black (N 1) to olive black (5 Y 2/1) very fine grain. As above with increase in siltstone, moderate induration, very slightly micaceous.
14520-14530	Sandstone and arkosic sands white (N 9) to moderate reddish brown (10 R 4/6) coarse grain. Abundant orange potash-feldspar? Lithology change, Norphlet?
14530-14540	Arkosic sands and sandstone white (N 9) to moderate reddish brown (10 R 4/6) medium to coarse grain. Abundant orange potash-feldspar with angular sandstone unsorted.
14540-14550	As above.
14550-14560	As above.
14560-14570	As above.
Total Depth	

PLACID OIL CO.

10-3 U.S.A.
Permit 769 Liberty County

11780-11790	Siltstone to sandstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine to fine to medium grain. Moderate induration, very finely micaceous. Approximately less than 1% loose quartz sand coarse grain. Trace of calcareous cement medium grain sandstone. Approximately 1-2% gray siltstone. 95% red sandstone and siltstone.
11790-11800	As above.
11800-11810	As above. Slight increase in olive gray (5 Y 4/1) to dark greenish gray (5 GY 4/1) siltstone to fine grain sandstone. Trace of limestone dusky yellowish brown (10 YR 2/2).
11810-11820	Siltstone to sandstone very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) and olive gray (5 Y 4/1) very fine to fine to medium grain. As above; increase in olive gray (5 Y 4/1) to dark greenish gray (5 GY 4/1) siltstone to fine grain sandstone. 90% red sandstone and siltstone.
11820-11830	Siltstone to sandstone olive gray (5 Y 4/1) to dark greenish gray (5 GY 4/1) very fine to fine to medium grain. Moderate to weak induration, siltstone dark greenish gray

	(5 GY 4/1) to olive gray (5 Y 4/1) sandstone fine grain, black specks as in P-957 Core #1. 90% red sandstone and siltstone.
11830-11840	As above, sandstone calcareous cement very fine grain light greenish gray (5 G 8/1). Plant remains? Approximately 80% red sandstone and siltstone.
11840-11850	As above.
11850-11860	As above.
11860-11870	As above.
11870-11880	As above; very coarse grain quartz sand, subrounded, sphericity. Less than 70% red sandstone and siltstone.
11880-11890	As above; sandstone calcareous cement brownish gray (5 YR 4/1) to light greenish gray (5 G 8/1). 60% red sandstone and siltstone.
11890-11900	As above.
11900-11910	As above.
11910-11920	As above; light greenish gray (5 G 8/1) to olive gray (5 Y 4/1) sandstone breaks up with hydrochloric acid.
11920-11930	As above. 50% red sandstone and siltstone.
11930-11940	As above. 50% red sandstone and siltstone.
11940-11950	Sandstone to siltstone olive gray (5 Y 4/1) to dark greenish gray (5 GY 4/1) fine to medium and very fine grain. Weak induration, calcareous cement, siltstone moderately indurated as in P-957 core. 50% red sandstone and siltstone. Interbedded sandstone and siltstone. Very calcareous.

11950-11960	As above with a trace of dolomite? Limestone dusky brown (5 YR 2/2) very fine crystalline.
11960-11970	As above.
11970-11980	As above with a trace of limestone dusky brown (5 YR 2/2) very fine crystalline, dense.
11980-11990	As above.
11990-12000	As above.
12000-12010	As above.
12010-12020	As above. Brownish gray (5 YR 4/1) calcareous sandstone fine grain. 40% red sandstone and siltstone.
12020-12030	As above. Trace of limestone dusky yellowish brown (10 YR 2/2) very fine crystalline.
12030-12040	As above.
12040-12050	As above; brownish bray (5 YR 4/1) calcareous sandstone fine grain. 40% red sandstone and siltstone.
12050-12060	As above. Plant remains? Approximately 15% red sandstone and siltstone.
12060-12070	As above with very thin bedded calcareous sandstone with argillaceous seams. Plant remains? Approximately 10% red sandstone and siltstone.
12070-12080	As above. Brownish gray (5 YR 4/1) calcareous sandstone fine grain. Approximately 10% red sandstone and siltstone.
12080-12090	As above. Approximately 15% red sandstone and siltstone.

12090-12100 As above. Calcsiltite dusky yellowish brown (10 YR 2/2). Approximately 10% red sandstone and siltstone.

12100-12110 As above.

12110-12120 Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine crystalline. Very thinly bedded, (1 mm) limestone argillaceous layers with abundant as above.

12120-12130 As above.

12130-12140 Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) to dark yellowish brown (10 YR 4/2) micrite to very fine crystalline. Hard, dense limestone, very yellowish brown (10 YR 4/2) most calcarenite-siltite: very thinly bedded. Some chips show possible micrite grading into calcarenite.

12140-12150 As above.

12150-12160 As above.

12160-12170 As above.

12170-12180 As above.

12180-12190 Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) to dark yellowish brown (10 YR 4/2) micrite. Hard, dense, very thinly bedded argillaceous layers with calcisiltite as above.

12190-12200 As above.

12200-12210 Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) to dark yellowish brown (10 YR 4/2) micrite and sandstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) fine grain. As above with an increase in fine grain red sandstone. Approximately 20% red sandstone and siltstone.

12210-12220 Siltstone very fine grain and sandstone fine grain olive gray (5 Y 4/1) to olive black (5 Y 2/1). Moderate induration, very finely micaceous, increasing in fine grain red sandstone. Approximately 30% red sandstone and siltstone.

12220-12230 As above.

12230-12240 As above. Decrease in red sandstone. 30% red sandstone and siltstone.

12240-12250 As above with limestone mica plate (lost circular material?). Approximately 20% red sandstone and siltstone.

12250-12260 As above. Approximately 1% limestone as in 12140-12150

12260-12270 As above. Abundant loose quartz sand, angular very dusky red (10 R 2/2).

12270-12280 As above.

12280-12290 As above.

12290-12300 As above. Large mica plate.

12300-12310 As above.

12310-12320 Siltstone to sandstone olive gray (5 Y 4/1) to dark greenish gray (5 GY 4/1) very fine to fine grain. Moderately indurated siltstone. Sandstone not calcareous. Abundant loose sand, very dusky red (10 R 2/2). Approximately 30% red sandstone and siltstone.

12320-12330 As above.

12370-12380	Sandstone moderate reddish orange (10 R 6/6) to clear, very coarse grain. Loose, very coarse sand quartz and feldspar, subrounded, subangular. High sphericity. <u>In Norphlet</u>.
12380-12390	As above.
12390-12400	As above, angular low sphericity.
12400-12410	As above. Abundant feldspar.
12410-12420	As above.
12420-12430	As above.
12430-12440	As above.
12440-12450	As above with chert white (N 9).
12450-12460	As above.
12460-12470	As above.
12470-12480	As above.
12480-12490	As above.
12490-12500	As above.
12500-12510	As above.
12510-12520	As above.
12520-12530	As above.
12530-12540	Anhydrite? white (N 9) very fine grain. Calcareous anhydrite? leaves white residue in hydrochloric acid, very soft. Lithology change.
12540-12550	As above.
12550-12560	As above.

12560-12570 As above.

12570-12574 As above.

EXXON COMPANY U.S.A.

16-3 Buckeye Cellulose Corporation
Permit 814, Franklin County

10990-11000	Siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine grain and sandstone transparent (5 R 8/2) to translucent (5 R 6/2) to white (N9) medium to coarse grain. Moderate to weak induration. Silica cement unsorted (red sandstone to siltstone - slightly micaceous). Approximately 10% sandstone. In Haynesville
11000-11010	As above with less than 17% greenish gray (5 G 6/1) fine grain sandstone, some showing iron stain.
11010-11020	As above with very coarse grain quartz.
11020-11030	As above. Trace of gray sandstone to siltstone.
11030-11040	As above
11040-11050	As above
11050-11060	As above
11060-11070	As above
11070-11080	As above
11080-11090	As above
11090-11100	As above. Conglomeratic sandstone
11100-11110	As above
11110-11120	As above
11120-11130	As above
11130-11140	As above
11140-11150	Siltstone to sandstone as above

11150-11160	Siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine to fine grain. Moderate induration, very finely micaceous, very slightly fissile.
11160-11170	Siltstone to sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine to fine grain. Moderate induration, very finely micaceous, slightly fissile. Sandstone well sorted; some light greenish gray (5 G 8/1) to greenish gray (5 G 6/1) iron stain contact. Less than 1% gray siltstone. Approximately 10-15% sandstone.
11170-11180	As above with 1 large piece dark greenish gray (5 GY 4/1) siltstone, fissile, weakly indurated.
11180-11190	Siltstone very fine grain and sandstone medium to fine grain dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2). Brick red siltstone, silghtly micaceous and medium grain white (N9) to rusty red quartz sandstone with calcite cement. Quartz angular to subangular. Some glauconite in quartz sandstone. Approximately 1% olive gray (5 Y 4/1) siltstone with calcite and dolomite? cement, mostly silica cement. Sandstone approximatley 10%. Interrelated red siltstone and medium grain sandstone. Probable minor unconformity (few grains of rounded red siltstone in sandstone).
11190-11210	Siltstone and sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grain. Red siltstone, slightly micaceous and medium grain white (N9) to rusty red quartz sandstone. Quartz angular to subangular. Few gray siltstone pieces olive gray (5 Y 4/1) to olive black (5 Y 2/1).

11210-11220	Sandstone medium grain and siltstone very fine grain dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2). White (N9) to clear quartz sandstone. Angular to subangular silica cement. 1-2% olive gray (5 Y 4/1) very fine grain siltstone.
11220-11230	Siltstone very fine grains and sandstone mediumg raindark reddish brown (10 R 3/4) to very dusky red (10 R 2/2). Slightly micaceous in part and 40% medium grain white (N9) to rusty red quartz sandstone with calcite cement mostly silica cement to quartz angular to subangular, scattered gray-green fine to medium grain sandstone, slight increase in gray siltstone.
11230-11240	Sandstone transparent (5 R 8/2) to translucent (5 R 6/2) to white (N9) to grayish red purple (5 RP 4/2) to dark reddish brown (10 R 3/4) medium grian, and siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine grain. White (N9) to clear quartz sandstone, subangular to subrounded. Scattered calcite cement with a slight increase in gray siltstone. Abundant red siltstone slightly micaceous. Trace of pyrite in gray siltstone. In upper Smackover?
11240-11250	As above, gray siltstone slightly increasing. Mostly sandstone.
11250-11260	Siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine grain, and sandstone transparent (5 R 8/2) to translucent (5 R 6/2) to white (N9) to graysih red purple (5 RP 4/2) to dark reddish brown (10 R 3/4) medium to coarse grain. Red slightly micaceous siltstone with white (N9) to clear quartz sandstone as above. Approximately 5% gray. 90% red.
11260-11270	As above increasing in sandstone

11270-11280	Sandstone transparent (5 R 8/2) to white (N9) and siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2). White (N9) to clear quartz sandstone. Some glauconite present in sandstone. 5% gray siltstone. Sandstone 10-15%.
11280-11290	As above with a trace of pale greenish very fine grain limestone. Scattered gray siltstone (approximately 1%).
11290-11300	Sandstone transparent (5 R 8/2) to white (N9), very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) medium grain, and siltstone olive gray (5 Y 4/ 1) to olive black (5 Y 2/1) very fine grain.
11300-11310	Siltstone transparent (5 R 8/2) to white (N9), very dusky red (10 R 2/2) to dark reddish brown (10 R 3/4) very fine grain, and sandstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) medium to coarse grain. Red slightly increasing siltstone with 10% gray siltstone. Abundant white (N9) to clear quartz sandstone as above.
11310-11320	Sandstone clear to white (N9) medium to coarse grain and siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2), olive gray (5 Y 4/1) very fine grain. As above with 20-30% increase in sandstone contact. Slight increase (approximately 5-7%) in gray siltstone.
11320-11330	As above
11330-11340	Siltstone and sandstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) as above with and increase in gray siltstone (10%) and rusty quartz sandstone. 70% red.
11340-11350	Siltstone and sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2). As above, mostly siltstone.

11350-11360	As above with an increase in sandstone white (N9) and green (glauconite?) sandstone? Iron stained. 90% red.
11360-11370	As above, mostly siltstone with sandstone as above. Trace of gray. 95% red.
11370-11380	As above with fine grain white (N9) limestone, trace of calcarenite (as in 387), and gray sltstone. Some of the white (N9) sandstone have inclusions of reounded red siltstone and glauconite. Limestone stringer? slickensides.
11380-11400	Siltstone and sandstone. Red slightly micaceous silt with 10-15% rusty red to white (N9) to green sandstone. Trace of scattered gray siltstone. Quartz medium grain angular to subrounded. 80% red.
11400-11410	Siltstone and sandstone white (N9) to clear quartz sandstone as above with red siltstone slightly micaceous in part 70-80% red. Slickensides.
11410-11420	As above
11420-11430	Limestone greenish gray (5 GY 6/1) Siltstone and sandstone as above with pale green fossil. Limestone fine grain globigerina(?) Porosity 15%. Limestone bed 20 feet lag.
11430-11440	Limestone (silty) olive gray (5 Y 4/1) to olive black (5 Y 2/1). Siltstone and sandstone as above with pale green to bluff fine grain limestone porosity 10-15%. No fossils evident.
11440-11460	Siltstone and sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2). Red slightly micaceous siltstone with rusty red-green (glauconite?) sandstone with 10% white (N9) to clear quartz. Trace (1%) gray. Sandstone 10-15%. 90% red.

11360-11370	As above, mostly siltstone with sandstone as above. Trace of gray. 95%
11380-11400	Siltstone and sandstone. Red slightly micaceous silt with 10-15% rusty red to white (N9) to green sandstone. Trace of scattered gray siltstone. Quartz medium grain angular to subrounded. 80% red.
11400-11410	Siltstone and sandstone white (N9) to clear quartz sandstone as above with red siltstone slightly micaceous in part 70-80% red. Slickensides.
11410-11420	As above
11420-11430	Limestone greenish gray (5 GY 6/1) Siltstone and sandstone as above with pale green fossil. Limestone fine grain globiguina? Porosity 15%. Limestone bed 20 feet lag.
11430-11440	Limestone (silty) olive gray (5 Y 4/1) to olive black (5 Y 2/1). Siltstone and sandstone as above with pale green to bluff fine grain limestone porosity 10-15%. No fossils evident.
11440-11460	Siltstone and sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2). Red slightly micaceous siltstone with rusty red-green (glauconite?) sandstone with 10% white (N9) to clear quartz. Trace (1%) gray. Sandstone 10-15%. 90% red.
11460-11470	Siltstone and sandstone. Red slightly micaceous siltstone with 2% gray slight micaceous siltstone. Abundant quartz sandstone angular to subrounded. Some iron stained. Scattered greenish (glauconite?) sandstone. Sandstone 10-15%. 90% red.
11470-11480	Siltstone dark reddish brown (10 R 3/4) very fine grain and sandstone transparent (5 R 8/2) to white (N9) mediumg rain. Red siltstone-slightly

micaceous with clear to white (N9) quartz medium grain. Scattered reddish fine to medium grain sandstone. Scattered gray siltstone. Sandstone 10-15% 90% red. Chert

11480-11500 Siltstone very fine grain and sandstone-medium grain dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2). Siltstone as above. Green to gray fine to medium grain quartz sandstone. Scattered rusty sandstone. Red shale slickensides. 95% red.

11500-11510 Siltstone very fine grain, sandstone medium grain and liemstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2). Siltstone as above. Scattered buff to tan very fine grain limestone. Scattered quartz sandstone red to white (N9) to clear. 5% gray siltstone. 95% red.

11510-11520 Siltstone very fine grain and sandstone medium graindark reddish brown (10 R 3/4) to very dusky red (10 R 2/2). As above, no limestone identified. 5% gray siltstone. 95% red.

11520-11530 Sandstone medium grain and siltstone very fine grain dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2). White (N9) to clear quartz sandstone, angular to subrounded red siltstone. Some of the sandstone have calcite cement 2-3% gray siltstone. 95% red.

11530-11540 Siltstone very fine grain and sandstone medium grain dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2). Red very slightly micaceous siltstone. Scattered white (N9) fine grain limestone. Abundant fine to medium grain red sandstone with white (N9) to clear quartz sandstone. 95% red.

11540-11550 As above. Green to gray glauconite? Sandstone with mica, 2-3% gray siltstone. Sandstone porosity 15-20%. 95% red.

11550-11560	As above. Red very slightly micaceous siltstone withfine to medium grain clear to white (N9) quartz sandstone, some calcite cement. Abundant red fine to medium grain sandstone. 2-3% gray siltstone.
11560-11570	As above with an increase in sandstone. Trace of gray siltstone.
11570-11580	As above with abundant white (N9) to clear calcite cemented quartz sandstone.
11580-11590	Siltstone very fine grain and sandstone fine to medium grain. Red very slightly micaceous siltstone with white (N9) to clear quartz sandstone. 95% red. 10-15% porosity.
11590-11600	As above with white (N9) to clear calcite cemented quartrz sandstone. 95% red. 10-15% porosity.
11600-11610	As above. Trace of gray siltstone.
11610-11620	As above with an increase in gray very fine grain siltstone (shale) 1-2% gray siltstone.
11620-11630	As above with scattered fine grain white (N9) to buff very argillaceous limestone. Calcarenite.
11630-11660	As above. Trace of limestone. Scattered to fine to medium grain green to gray micaceous quartz sandstone with calcite cement. Less than 1% gray siltstone.
11660-11670	As above with increasing gray siltstone (shale).
11670-11680	As above with an increase in reddish fine to medium grain sandstone with white (N9) calcite cement.
11680-11694	Siltstone, sandstone and limestone microspar? As above with white (N9) to buff calcarenite fine grain oolitic limestone (Oolites are gray) <u>In Smackover</u>

Core #1 Descriptions

11694-11695	Limestone micritic. Dark gray olitic limestone recrystalline pelloidal moldic filled with spar. Some milliolid. Scattered pyrite. Dense.
11695-11696	Limestone micritic. Light gray to light brown recrystalline oolitic limestone. Slight oils tains. Dense
11696-11697	Limestone micritic. Light gray, highly recrystalline oolitic liemstone with seams filled with argillaceous material. Dense
11697-11698	Limestone micritic. Light gray to light tan. Slight change in lithology. Oolite not recognized if present. Dense
11698-11699	Limestone micritic. Gray to light tan. Peloidal moldic. Dense
11699-11700	As above with spar. Very scattered vugular filled with argillaceous material. Dense
11700-11701	Limestone micritic gray with abundant dark gray argillaceous material. In layer form. Scattered miliolids? Dense
11701-11702	As above
11702-11703	Limestone micritic. Gray to light brown. Scattered sparry-calcite filling vugulars? or moldics. Dense
11703-11704	Limestone micritic, gray to light brown. Thsi sample lookgs pelletal but ahs been recrystallined to a high degree. Dense
11704-11705	Limestone micritic gray to light brown with seams filled with argillaceous material.
11705-11706	As above with scattered argillaceous material.

11706-11707	As above with seams filled with argillaceous material.
11707-11708	Limestone micritic gray to light brown, with abundant white (N9) foram like forms for algae?
11708-11709	Limestone micritic gray with styolitic seam composed of calcite, stained brown to black with argillaceous material. Very low porosity.
11709-11710	Limestone micritic gray to light brown.
11710-11711	As above. Pelletal?
11711-11712	Limestone micritic gray as above with abundant argillaceous material in seams. Dense
11712-11713	Limestone micritic gray to olive gray pelletal limestone? Some traces of tar. Dense
11713-11714	Limestone micritic gray to olive gray pelletal? limestone with spar. Some traces of tar. Sample recrystalline. Dense
11714-11715	Limestone micritic light gray slight granular, very fine to fine grained. Dense. Slight lithology change. More crystalline.
11715-11716	Limestone micritic light gray to light tan. Scattered very small vugulars (approximately .3-.5 mm) with finely crystalline calcareous iron filling cavities. Very slight oil stain. Less than 1% porosity.
11716-11717	As above. Dense
11717-11718	As above. Dense
11718-11719	Limestone micritic light gray with seams filled wiht argillaceous material. Scattered vugulars filled with spar. Dense. Lithology change.

11719-11720	As above large area of argillaceous material. Layer like. Dense.
11720-11721	Limestone micritic light gray. Dense.
11721-11722	Limestone micritic light gray with layer like argillaceous material. Dense.
11722-11723	Limestone micritic light gray. Dense.
11723-11724	Limestone micritic light gray. This sample is very recrystallined. Very abundant forams? and oolites. Dense. oolitic-biomicrite.
11725-11726	As above

Core #2 Descriptions

11739-11740	Limestone micrite light gray. Small recrystallined forams, oil stained crystals. Scattered spar. Low. vuggy. Stained. Probable flushed zone.
11740-11741	As above, no sigh of forams. Dense. stained
11741-11742	As above, this sample is granular, with absorb water readily. Low. 3-7% microvuggular. Stained.
11742-11743	Limestone micrite light gray todark gray to brown stained, granular (crystals). Dense. Stained.
11743-11744	Limestone micrite light gray. This sample has very small recrystallined forams? or pellets? small vugulars granular. Dense. Stained.
1744-1745	Limestone micrite light gray, vugular porosity with cracks, granular. 2-3% vuggy.
11745-11746	As above with yuellow to black very high luster anhydrite?

11746-11747	As above. No anhydrite.
11747-11748	As above.
11748-11749	As above.
11749-11761	Not cored?

Core #3 Descriptions

11761-11762	Limestone micrite dark gray-brown granular (crystalline) 15-20% porosity.
11762-11763	As aove with light gray dense layer micrite.
11763-11764	As above. The last two samples seem to be rewatered limestone. Some pieces of dense micrite intermixed with microcrystalline calcite, with 20% porosity.
11764-11765	Liemstone micrite gray to brown granular. 10-15% porosity brown and black stained.
11765-11766	As above, abundant microvugulars lined dogtooth calcite crystals with Rhombs with crystalline calcite and dolomite? 20% porosity, brown and black stained.
11766-11767	As above, abundant dense micrite with spar. 10-15% porosity brown and black stained
11767-11768	As above. 10% porosity
11768-11769	AS above. 10-15% porosity
11769-11770	As above, abundant spar. 15-20% porosity.
11770-11771	As above.
11771-11772	As above.
11772-11773	As above with large vugulars. 10% porosity.

11773-11774	As above. 5-10% porosity
11774-11775	As above with fractures in dense micrite.
11775-11776	Limestone micrite light gray to brown granular, very fine intracrystalline porosity. Styolitic structures (calcite). 15-25% porosity.
11776-11777	As above. 5-10% porosity
11777-11778	Limestone micritie lgiht gray to brown, granular with microvugulars, fractured porosity, abundant spar. Probable filling large vugs. 10-15% porosity.
11778-11779	As above. 15-25% porosity
11779-11780	As above. 5-10% porosity
11780-11781	As above. Less than 10% porosity
11781-11782	As above. 15-25% porosity
11782-11783	As above
11783-11784	Limestone micrite light gray to brown with abundant large vugs lined with crystals of calcite and dolomtie. Abundant spar filling vugs. 15-20% porosity.
11784-11785	As above
11785-11786	Limestone micrite light to brown with white (N9); dense white (N9) limestone contains unrecognizable intraclsts ± 10% porosity. Slight lithology change.
11786-11787	Limestone micrite light granular with spar. More rounded grains not as crystalline as (11783-85).
11787-11788	As above
11788-11789	As above

11789-11790	Limestone micrite light gray to brown with abundant vugs lined with crystals (calcite, dolomite) with spar. 15-20% porosity.
11790-11791	Limestone micrite light gray to brown with spar with fractures. Scattered vugs. ± 7% porosity.
11791-11792	As above

Core #4 Descriptions

11798-11799	Limestone micrite brown with abundant vugs lined with crystals calcite. 5-8% porosity.
11799-11800	Limestone micrite brown with abundant spar filling vugs. 10-15% porosity.
11800-11801	As above. ± 10% porosity
11801-11802	As above. ± 20% porosity
11802-11803	As above. Increase in spar content
11803-11804	As above. ± 15% porosity
11804-11805	As above
11805-11806	Limestone micrite light gray to brown with abundant vugs lined with crystals of calcite. Abundant spar filling vugs. Less than 10% porosity.
11806-11807	As above. ± 15% porosity
11807-11808	As above. 10-15% porosity
11808-11809	Limestone micrite light gray to brown with scattered vugs. Scattered spar. 3-4% porosity.
11809-11810	As above
11810-11811	As above. ± 5% porosity
11811-11812	As above with styolitic calcite (black to white) 2-3% porosity.

11812-11813	Limestone micrite light gray to brown granular microvugular. 2-3% porosity.
11813-11814	As above with abundant spar. ± 5% porosity.
11814-11815	Limestone micrite light gray to brown microvugular porosity abundant spar. 5-8% porosity.
11815-11816	Limestone micrite light gray to gray with microvugulars. Abundant spar with anhydrite? filling some vugs. 5-8% porosity.
11816-11817	As above. 10-15% porosity
11817-11818	As above. 15-20% porosity
11818-11819	As above. 10-15% porosity
11819-11820	As above. 10-15% porosity
11820-11821	Limestone micrite light grya to gray with scattered microvugulars. 5-8% porosity
11821-11822	As above. 10% porosity
11822-11823	As above with anhydrite filling some vugs. 5-8% porosity.
11823-11824	As above. 3-5% porosity.
11824-11825	Limestone micrite light gray with microvugular porosity. 2-5% porosity.
11825-11826	Limestone micrite light gray to brown with microvugular porosity. Less than 2% porosity.
11826-11827	Limestone micrite light gray with microvugular porosity with abundant brown crystalline calcite in some vugs. This si present in the last few samples. 5-7% porosity.
11827-11828	As above. 2-5% porosity

11828-11829	As above. 5-7% porosity
11829-11830	As above. 10% porosity
11830-11831	As above with anhydrite. 10-15% porosity.
11831-11832	As above with anhydrite. Peloidal moldic? 10-15% porosity.
11832-11833	As above. 2-3% porosity.
11833-11834	As above. 4-6% porosity.
11834-11835	As above. Less than 5% porosity.
11835-11836	Limestone micrite light gray to brown. Scattered microvugular porosity. Rock seems more dense crystalline than above. Dense. Slight change in lithology.
11836-11837	Limestone micrite light gray to brown. Microvugular porosity. Slightly more crystalline than above. 5-7% porosity.
11837-11838	As above
11838-11839	Limestone micrite light gray to brown with microvugular porosity with abundant brown crystalline calcite in some vugs. 4-5% porosity.
11839-11840	As above with styolites
11840-11841	As above. 5-7% porosity.
11841-11842	As above. 7-9% porosity.
11842-11843	Limestone micrite light gray to brown. Granular with anhydrite with brown crystalline calcite. 10-15% porosity. Change in lithology.
11843-11844	Limestone micrite light gray to brown granular with anhydrite and brown crystalline calcite. Microvugular porosity. 15-20% porosity.

11844-11845	Limestone micrite light gray to brown, slightly denser. Not as crystalline as above. Microvugular porosity. 2-5% porosity.
11845-11846	Limestone micrite light gray to brown, very dense microcrystalline with anhydrite (alabaster). Less than 1% porosity.
11846-11847	Limestone micrite light gray to brown with anhydrite and brown crystalline calcite microvugular porosity. 5-10% porosity.
11847-11848	As above with some very dense gray cryptocrystalline liemstone. 2-3% porosity.
11848-11849	Limestone micrite light gray to brown. Abundant styolitic stained brown structure (calcite). Less than 1% porosity.
11849-11850	Limestone micrite light gray to brown, with very dense gray limestone with scattered anhydrite. Less than 4% porosity.
11850-11851	Limestone micrite light gray to brown with pieces of very dense brown limestone with abundant anhydrite. 5-7% porosity.
11851-11852	Limestone micrite light gray to brown with pieces of very dense gray limestone. Less than 5% porosity.
11852-11853	Limestone micrite light gray to brown granular. Microvugular porosity with scattered anhydrite. Tan to brown crystalline calcite. 10-15% porosity.
11853-11854	As above with pieces of very dense gray limestone. 5-8% porosity.
11854-11855	Limestone micrite light gray to brown granular, microvugular porosity with anhydrite with very dense gray limestone. 5-10% porosity.

11855-11856	As above. 10-15% porosity
11856-11858	Not recovered.

Core #5 Descriptions

11858-11859	Limestone micrite gray very dense with crystalline brown calcite, abundant anhyudrite. 2-3% porosity.
11859-11860	Limestone micrite light gray, slightly granular with abundant anhydrite with crystalline calcite brown to white. 5-8% porosity.
11860-11861	Limestone and anhydrite micrite light gray, slightly granular with very abundant anhydrite with crystalline calcite brown to white. 10-12% porosity.
11861-11862	Limestone micrite light gray granular. Less than 5% porosity.
11862-11863	Limestone micrite light gray to brown granular with anhydrite microvugular porosity with crystalline tan to brown calcite 10-15% porosity.
11863-11864	Limestone light olive gray (5 Y 6/1) fine grain crystalline. Microspar to spar recrystalline? Large micaceous clast Intracrystalline and vuggy approximately 10-15% porosity. Oil stained.
11864-11865	Limestone light olive gray (5 Y 6/1) fine grain crystalline. Microspar to spar (in fill) - Large white (N9) spar third generation? Large clast micaceous. Intracrystalline and vuggy approximately 10-15% porosity.
11865-11866	Limestone light olive gray (5 Y 6/1) fine grain crystalline to micrite microspar to spar (in fill) very tight micaceous hard streak (or very large clast) Intracrysatlline and vuggy approximately 10-15% porosity. Patchy

11866-11867	Thin-Section
11867-11868	Limestone light brownish gray (5 YR 6/1) fine crystalline to micrite. Microspar to spar recrystalline? Large micaceous clast.
11868-11869	Limestone light olive gray (5 Y 6/1) to greenish gray (5 GY 6/1) fine grain crystalline to micrite. Fine grain crystalline grades into denser micrite.
11869-11870	As above appears to be a clast?
11870-11871	Thin-Section
11871-11872	Limestone light brownish gray (5 YR 6/1) to light olive gray (5 Y 6/1) fine grain crystalline to micrite. Fine crystals with vugs infilled with spar and possibly third generation white (N9) spar. Intraclast? vuggy 10-15% porosity.
11872-11873	Limestone light brownish gray (5 YR 6/1) fine grain crystalline to micrite. Fine crystalline grades into denser micrite. Intraclast?
11873-11874	Thin-Section
11874-11875	Limestone light brownish gray (5 YR 6/1) to light olive ray (5 Y 6/1) fine grain crystalline to micrite. Intraclast with vugs infill spar - third generation white (N9) spar?
11875-11876	Limestone light olive gray (5 Y 6/1) fine grain crystalline to micrite. Fine crystals grade into denser areas. Patchy Intraclast?
11876-11877	Limestone light olive gray (5 Y 6/1) and olive gray (5 Y 4/1) fine grain crystalline to micrite. As above.
11877-11878	Limestone olive gray (5 Y 4/1) micrite. Hard dense micaceous.

11878-11879	Sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine grain. Top of Norphlet?
11879-11902	Sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine grain. Very thinly bedded or stratified 899-902 very fine grain shale? siltstone.
11900-11910	Siltstone and sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grain. Moderate induration, no mica with abundant transparent (5 R 8/2) to white (N9) quartz sand (loose) with dusky yellowish brown (10 YR 2/2) limestone, crystalline vuggy porosity cavings? Approximately 10%?
11910-11920	As above
11920-11930	As above. Red siltstone shiny in part.
11930-11940	As above
11940-11950	As above. Approximately 30% sand.

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20-3 Neal Lumber and Manufacturing Co.
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12690-12700 Siltstone dark reddish brown (10 R 3/4) to dusky brown (5 YR 2/2) very fine to fine grained, and sandstone clear to dark reddish brown (10 R 3/4), poorly indurated with clear reddish iron cement, sandstone (10%), very slightly micaceous. Sandstone has 15-20% porosity. In Haynesville Formation.

12700-12710 Siltstone dark reddish brown (10 R 3/4) to dusky brown (5 YR 2/2) very fine to fine grained, and sandstone clear to dark reddish brown (10 R 3/4), poorly indurated, slight increase in clear sandstone (12-15%), some conglomerate medium to coarse grained and coarse grained quartzitic sandstone. Sandstone has 15-20% porosity.

12710-12720 Siltstone dark reddish brown (10 R 3/4) to dusky brown (5 YR 2/2) very fine to fine grained, and sandstone clear to dark reddish brown (10 R 3/4), poorly indurated with clear sandstone (12-15%), some conglomerate medium to coarse grained and coarse grained quartzitic sandstone. Trace of coal? Sandstone has 15-20% porosity.

12720-12730 As above.

12730-12740	Siltstone dark reddish brown (10 R 3/4) to dusky brown (5 YR 2/2) very fine to fine grained, poorly indurated, slight decrease in clear sandstone (5%); 1-2% light green fine grained sandstone, some of the siltstone and shale have medium grains of quartz.
12740-12750	Sandstone clear to red fine to coarse grained and siltstone dark reddish brown (10 R 3/4) to dusky brown (5 YR 2/2) very fine to fine grained, clear quartz and iron stained? Grain subangular to round, moderagely indurated. 15-25% porosity.
12750-12760	Siltstone dark reddish brown (10 R 3/4) to dusky brown (5 YR 2/2) very fine to fine grained and sandstone clear to dark reddish brown (10 R 3/4) fine to coarse grained, decreasing sandstone. Grains show contact of both lithologies; siltstone slightly micaceous. Interbedded.
12760-12770	Siltstone dark reddish brown (10 R 3/4) to dusky brown (5 YR 2/2) very fine to fine grained and sandstone clear to dark reddish brown (10 R 3/4) fine to coarse grained, iron stained contact in some grains; some quartzite chips.
12770-12780	Sandstone clear to dark reddish brown (10 R 3/4) fine to coarse grained, and siltstone dark reddish brown (10 R 3/4) very fine to fine grained, 10-15% sandstone; angular to subangular; moderately indurated. Trace chert. Sandstone has 15-25% porosity. Trace of coal?
12780-12790	Sandstone dark reddish brown (10 R 3/4) to dusky brown (5 YR 2/2) fine to coarse grained, and siltstone clear to dark reddish brown (10 R 3/4) very fine to fine grained; 10-15% sandstone; angular to

subangular; moderately indurated; iron-stained. Contact in some grains of sandstone. Trace of light green waxy siltstone and glauconitic sandstone.

12790-12800 As above.

12800-12810 As above.

12810-12820 As above.

12820-12830 Siltstone dark reddish brown (10 R 3/4) to dusky brown (5 YR 2/2) very fine to fine grained, and sandstone clear to dark reddish brown (10 R 3/4) fine to coarse grained; decreasing sandstone content; iron-stained. Contact in some grains of sandstone. Trace of light green waxy siltstone and glauconitic sandstone.

12830-12840 As above.

12840-12850 Sandstone dark reddish brown (10 R 3/4) fine to coarse grained and siltstone dark reddish brown (10 R 3/4) very fine to fine grained. Sandstone increasing; light gray, siltstone and abundant loose quartz sand grains.

12850-12860 Siltstone dark reddish brown (10 R 3/4) to dusky brown (5 YR 2/2) very fine to fine grained and sandstone clear to dark reddish brown (10 R 3/4) fine to coarse grained. Sandstone decreasing. Siltstone as above with greenish waxy siltstone and iron-stained contact.

12860-12870 As above.

12870-12880 As above.

12880-12890 As above.

12890-12900	Sandstone clear to white fine to medium grained; angular to subrounded, moderately indurated. Glauconitic; with potash-feldspar? Abundant loose quartz sand, fine to coarse grained. 15-25% porosity.
12900-12910	As above.
12910-12920	Siltstone dark reddish brown (10 R 3/4) to dusky brown (5 YR 2/2) very fine to fine grained, and sandstone clear to white fine to medium grained. Decreasing in sandstone; siltstone moderately indurated, slightly fissile, slightly micaceous. 15-25% porosity.
12920-12930	Siltstone dark reddish bronw (10 R 3/4) to dusky brown (5 YR 2/2) very fine to fine grained, and sandstone clear to dark reddish brown (10 R 3/4) fine to medium grained, with red sandstone fine to medium grained. Well sorted. 15-25% porosity.
12930-12940	Siltstone dark reddish brown (10 R 3/4) to dusky brown (5 YR 2/2) very fine to fine grained. Moderately indurated, slightly fissile, slightly micaceous.
12940-12950	Sandstone clear to green fine to medium grained. Moderately indurated, well sorted, very glaucanitic with loose coarse quartz grains. 15-25% porosity. Coal-like material.
12950-12960	Limestone light brownish gray (5 YR 6/1) to dusky yellowish brown (10 YR 2/2) very fine crystalline. Tan to gray, recrystallized, dense, probably pelletal; some pelloids could be superficial oolites. Approximately 2% gray siltstone shale. 60% red. <u>Lithology change</u>. (10 feet lag).

12960-12970	Limestone light brownish gray (5 YR 6/1) to dusky yellowish brown (10 YR 2/2) very fine crystalline. Tan to gray; probably pelletal with 12% green shale, fissile, moderately indurated, waxy. 5% gray. 20% red sandstone and siltstone.
12970-12974	Limestone light brownish gray (5 YR 6/1) to dusky yellowish brown (10 YR 2/2), very fine crystalline. Tan to gray; probably pelletal. Trace chert. 5-8% gray. 20% red sandstone and siltstone.

Core Description

12974-12975	Limestone dusky yellowish brown (10 YR 2/2) very fine crystalline. Peloid .25 mm, well sorted, spines? burrows? spar. Packstone.
12975-12976	Limestone dusky yellowish brown (10 YR 2/2) very fine crystalline. Peloids - some superficial oolites? Spar amount, long needle spar center. Packstone. Oolitic (microspar).
12978-12979	Limestone olive gray (5 Y 4/1) very fine grained to micritic. Argillaceous, well indurated, intraclasts? Wackestone.
12980-12981	Limestone olive black (5 Y 2/1) micritic. Well indurated, argillaceous. Mudstone.
12982-12983	Limestone dusky yellowish brown (10 YR 2/2) micritic and shale olive black (5 Y 2/1) very fine grained. Limestone hard mudstone. Shale-fissile friable when wet. Trace pyrite. Mudstone.
12983-12984	Limestone dusky yellowish brown (10 YR 2/2) micritic. Limestone hard mudstone. Mudstone.

12985-12986	Shale olive gray (5 Y 4/1) and olive black (5 Y 2/1) micritic. Shale fissile, slightly micaceous, friable when wet.
12986-12987	Limestone olive gray (5 Y 4/1) microspar. Well indurated, recrystallized. Mudstone.
12990-12991	Limestone olive gray (5 Y 4/1) micritic and microspar. Well indurated, recrystallized. Mudstone.
12991-12992	Limestone olive gray (5 Y 4/1) and olive black (5 Y 2/1) micritic. Well indurated. Mudstone.
12993-12994	Limestone olive black (5 Y 2/1) micritic. Well indurated. Mudstone.
12994-12995	As above.
12995-12996	Limestone olive gray (5 Y 4/1) micritic. Well indurated, some spar infill? Mudstone.
12997-12998	Shale and siltstone olive black (5 Y 2/1) very fine to coarse grained. Very fissile, moderate to poor induration.
12998-12999	Limestone dark yellowish brown (10 YR 2/2) to olive black (5 Y 2/1) micritic. Well indurated, possibly recrystallized peloids. Mudstone.
12999-13000	Limestone dark yellowish brown (10 YR 2/2) micritic. Well indurated, possibly recrystallized peloids. Mudstone.
13000-13001	Limestone olive black (5 Y 2/1) micritic. Well indurated, recrystallized. Mudstone.
13002-13003	Siltstone and shale olive gray (5 Y 4/1) very fine. Moderate to poor induration - when wet, very fissile.

13003-13004	Shale olive gray (5 Y 4/1). Moderate to poor induration.
13004-13005	Shale and limestone olive gray (5 Y 4/1). Moderate to poor induration, calcareous.
13005-13006	Shale and limestone olive gray (5 Y 4/1). Very calcareous.
13007-13008	Siltstone dusky yellowish brown (10 YR 2/2) very fine grained. Well indurated, fissile.
13013-13014	Siltstone olive gray (5 Y 4/1) to olive black (5 Y 2/1) very fine grained. Well indurated, fissile.
13014-13015	Siltstone olive gray (5 Y 4/1) very fine grained and sandstone olive black (5 Y 2/1) fine grained. Well indurated, very thin (1-3 mm) sandstone streak well sorted.
13015-13016	Siltstone dusky yellowish brown (10 YR 2/2) very fine grained. Well indurated, fissile.
13018-13019	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated as 13014.
13019-13020	As above.
13020-13021	Siltstone and shale olive black (5 Y 2/1) very fine grained. Well indurated, very fissile with 1 mm thin sandstone streaks.
13021-13022	As above.
13022-13023	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated.
13023-13024	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly micaceous.
13024-13025	As above.

13025-13026	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly micaceous. Trace of very small plant-like remains.
13026-13027	As above.
13027-13028	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, very micaceous, fissile. Increasing mica.
13028-13029	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated. Trace of very fine plant-like remains? Decrease in mica.
13030-13031	Siltstone olive black (5 Y 2/1) very fine grained and sandstone olive gray (5 Y 4/1) fine grained. Well indurated, with 1-2 mm thick sandstone streaks. Decrease in mica.
13031-13032	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly micaceous with a trace of plant remains?
13032-13033	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly micaceous, with a trace of plant remains? Sandy.
13033-13034	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly micaceous. Trace of plant-like grains.
13034-13035	As above.
13035-13036	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, micaceous, sandy.
13036-13037	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, micaceous.
13037-13038	As above.

13038-13039 As above.

13039-13040 As above.

13040-13041 Siltstone olive black (5 Y 2/1) very fine grained and sandstone olive gray (5 Y 4/1) fine grained. Well indurated, micaceous with 2-3 mm sandy streaks.

13041-13044 No samples.

Ditch Samples

13045-13050 Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly fissile, slightly micaceous, 5-7% sandstone clear to red, 2-3% limestone as in core. 60% red sandstone and siltstone.

13050-13060 As above. 50% red sandstone and siltstone.

13060-13070 Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly fissile, slightly micaceous. 10-15% sandstone clear to red. 40% red sandstone and siltstone.

13070-13080 As above. 50% red sandstone and siltstone.

13080-13090 Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly fissile, slightly micaceous. Approximately 10% sandstone clear to light gray, 2-3% limestone dark yellowish brown (10 YR 2/2) to olive black (5 Y 2/1). 50% red sandstone and siltstone.

13090-13100 Siltstone olive black (5 Y 2/1) very fine grained and sandstone clear to olive gray (5 Y 4/1) fine grained. Well indurated, slightly fissile, slightly micaceous. 10-15% sandstone. 40% red sandstone and siltstone.

13100-13110	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly fissile, slightly micaceous. 2-3% sandstone. 4-5% limestone dark yellowish brown (10 YR 2/2) to olive black (5 Y 2/1). 40% red sandstone and siltstone.
13110-13120	As above.
13120-13130	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly fissile, slightly micaceous. 2-3% limestone.
13130-13140	As above.
13140-13150	As above.
13150-13160	As above.
13160-13170	As above.
13170-13180	As above.
13180-13190	As above.
13190-13200	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly fissile, slightly micaceous. 1-3% limestone. 20% red sandstone and siltstone.
13200-13210	As above.
13210-13220	Limestone brownish gray (5 YR 4/1) very fine crystalline. Poor to moderate induration. 85% gray siltstone. Very fine porosity. Lithology change.
13220-13230	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly fissile, slightly micaceous. 4-5% limestone as above.

13230-13240	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly fissile, slightly micaceous, with 2-3% limestone as above.
13240-13250	Siltstone olive black (5 Y 2/1) very fine grained and sandstone clear to medium dark gray (N 4) very fine to fine grained. Well indurated, slightly fissile, slightly micaceous with slightly increasing sandstone approximately 2-3%. Limestone as above 1-2%.
13250-13260	Siltstone olive black (5 Y 2/1) very fine grained and sandstone clear to medium dark gray (N 8) very fine to fine grained. Well indurated, slightly fissile, slightly micaceous with slightly increasing sandstone approximately 5-7% weakly indurated. Limestone as above 1-2%.
13260-13270	As above.
13270-13280	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly micaceous, slightly fissile. 1-2% limestone.
13280-13290	As above.
13290-13300	As above.
13300-13310	As above.
13310-13321	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly micaceous, slightly fissile. Slightly increasing sandstone clear and glauconitic.
13321-13330	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly micaceous, slightly fissile. Increasing 3-5% sandstone slightly glauconitic? Fine to medium grained.

13330-13340	Sandstone clear to medium dark gray (N 4) fine to medium grained and siltstone olive black (5 Y 2/1) very fine grained. Sandstone slightly glauconitic with siltstone well indurated, slightly micaceous, slightly fissile. 1-2% limestone.
13340-13350	As above.
13350-13360	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly micaceous, slightly fissile, with sandstone slightly glauconitic.
13360-13370	Siltstone olive black (5 Y 2/1) very fine grained and sandstone clear to medium dark gray (N 4) very fine crystalline. Sandstone slightly glauconitic. Siltstone well indurated, slightly micaceous, slightly fissile. Increasing limestone 2-3%.
13370-13380	Limestone dusky brown (5 YR 2/2) to moderate yellowish brown (10 YR 5/4) very fine crystalline. Very dense hard and very fine grained very soft (brownish gray 5 YR 4/1).
13380-13390	Limestone dusky brown (5 YR 2/2) to moderate yellowish brown (10 YR 5/4) to brownish gray (5 YR 4/1). Very dense hard and very fine grained very soft (brownish gray 5 YR 4/1).
13390-13400	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly micaceous, slightly fissile with very dense hard and very fine grained very soft (brownish gray 5 YR 4/1), limestone decreasing 3-5%

13400-13410	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly micaceous, slightly fissile, slightly increasing sandstone clear to medium dark gray.
13410-13420	Limestone dusky brown (5 YR 2/2) to moderate yellowish brown (10 YR 5/4) to brownish gray (5 YR 4/1) very dense hard.
13420-13430	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine crystalline. Hard dense, some show very fine bedding? 60% gray.
13430-13440	As above.
13456-13460	As above.
13460-13470	Siltstone olive black (5 Y 2/1) very fine grained. Well indurated, slightly micaceous, slightly fissile with 3-5% limestone hard dense, some show very fine bedding?
13470-13480	As above.
13480-13494	Siltstone olive black (5 Y 2/1) very fine grained and sandstone clear to red fine to coarse grained. Well indurated, slightly micaceous, slightly fissile with increasing conglomeratic sandstone 1-2%. Potash-feldspar and green glauconite fine grained sandstone. Lithology change. <u>In Norphlet</u>.
13494-13500	Sandstone clear to red-orange fine to coarse grained. Arkosic sands 10-15%; abundant orange potash-feldspar; increasing red (very dusky red 10 R 2/2) siltstone-sandstone.
13500-13510	Sandstone clear to red fine to coarse grained. Arkosic sands (85%) abundant orange potash-feldspar.

13510-13520	Sandstone clear to red fine to coarse grained. Arkosic sands (60%) abundant 20% gray siltstone, loose quartz sand.
13520-13526	As above.

Core Descriptions

13526-13527	Siltstone olive black (5 Y 2/1) very fine grained. Hard, slightly micaceous, slightly fissile.
13527-13528	As above.
13528-13529	Sandstone olive gray (5 Y 4/1) to orange conglomeratic. Poorly sorted. 15-20% porosity.
13529-13530	Sandstone olive gray (5 Y 4/1) to orange conglomeratic. Poorly sorted large clast of gray siltstone. 15-20% porosity.
13530-13531	Siltstone to sand very dusky red (10 R 2/2) very fine to coarse grained. Very slightly micaceous. Less than 10% porosity.
13531-13532	As above.
13532-13533	Siltstone very dusky red (10 R 2/2) very fine to coarse grained, very micaceous, decreasing coarse grain - thinly bedded. Less than 10% porosity.
13533-13534	As above.
13534-13535	Siltstone very dusky red (10 R 2/2) very fine to coarse grained. Very thinly bedded - siltstone - fine sandstone. Scattered coarse grain, well rounded quartz grains. Less than 10% porosity.
13535-13536	As above.

13536-13537	As above.
13537-13538	As above.
13538-13539	Sandstone grayish red (5 R 4/2) to very dusky red (10 R 2/2) very fine to coarse grained. Massive moderate induration with scattered coarse grains. 10-15% porosity.
13539-13540	As above.
13540-13541	As above.
13541-13542	Sandstone grayish red (5 R 4/2) to very dusky red (10 R 2/2) very fine to coarse grained. Massive moderate induration, abundant coarse grain rounded to subrounded quartz, slightly calcareous. 10-15% porosity.
13542-13543	Sandstone grayish red (5 R 4/2) to very dusky red (10 R 2/2) very fine to fine grained. Massive moderate induration, well sorted. 10-15% porosity.
13543-13544	Sandstone and siltstone grayish red (5 R 4/2) to very dusky red (10 R 2/2) very fine to fine grained. Contact conglomerate sandstone and very fine siltstone. 10-15% porosity.
13544-13545	As above.
13545-13546	Sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to coarse grained and siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grained. Sandstone interbedded with siltstone 3-5 mm layers?
13546-13547	Siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grained. Slightly fissile, very micaceous layers.

13547-13548	Sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to coarse grained and siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grained. Sandstone interbedded with siltstone.
13548-13549	As above.
13549-13550	As above.
13550-13551	Sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to coarse grained and siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grained. Sandstone interbedded with siltstone; micaceous layers.
13551-13552	Sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to coarse grained. Moderage induration, abundant clean quartz. 10-15% porosity.
13552-13553	Sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to coarse grained and siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grained. Interbedded.
13553-13554	Sandstone conglomerate dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to coarse grained. Very coarse grain, potash-feldspar and quartz.
13554-13555	Sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to coarse grain and siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grain. Interbedded, moderate to poor induration, 7-8 mm siltstone layer.
13555-13556	Sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to coarse grain. Thinly layered. 15-20% porosity.

13556-13557	Sandstone conglomerate greenish gray (5 GY 6/1) to light greenish gray (5 G 8/1) fine to very coarse grain. Large potash-feldspar and quartz grains; glauconite?
13557-13558	As above.
13558-13559	Sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to medium grain. Thinly layered micaceous layers?
13559-13560	Sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to medium grain. Poor induration, thinly layered.
13560-13561	Sandstone conglomerate dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to very coarse grain. Poor induration, large potash-feldspar and quartz grains.
13561-13562	Conglomerate dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to very coarse grain. Arkosic.
13563-13564	Sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to coarse grain. Poor induration, thinly layered.
13564-13588	No samples.
13588-13600	Sandstone clear to orange fine to coarse grain arkosic sands as 13494-13500.
13600-13606	As above.

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12900-12910	Sandstone, transparent to light grayish red, porosity, interganular, grain size: medium, range: fine to coarse, subangular, rounded, medium sphericity, moderate induration, calcilutite matrix, silicic cement, interbedded.
12910-12920	Shale, blackish red, moderate induration, interbeddded, 25% quartz sand, iron stain.
12920-12930	Shale, blackish red, porosity, intergranular, moderate induration, interbedded, 10% quartz sand, iron stain, 01% pyrite, 05% Mica.
12930-12940	Sandstone, transparent to light grayish red, 15% porosity, intergranular, possibly high permeability, grain size: Medium, range: fine to coarse, subangular, rounded, medium sphericity, moderate induration, calcilutite matrix, interbedded.
12940-12950	No sample
12950-12960	Limestone, grayish brown to light brown, 15% porosity, moldic, intergranular, pin point vugs, grain type: oolite, crystals, moderate induration, sparry calcite cement, 02% pyrite, 01% anhydrite, sucrosic, high recrystallization.
12960-12965	As above
12965-12969	No sample
12969-12970	Sandstone, dark greenish gray to dark greenish gray, 05% porosity, intergranular, low permeability, grain size: very

fine, range: very fine to microcrystalline, good induration, silicic cement, interbedded, 05% mica, calcareous.

12970-12971	Sandstone, dark greenish gray to greenish black, 05% porosity, intergranular, low permeability, grain size: very fine, gane: very fine to microcrystalline, good induration, silicic cement, interbedded, 05% mica, calcareous.
12971-12972	Sandstone, dark greenish gray to greenish black, 05% porosity, intergranular, low permeability, grain size: very fine, range: very fine to microcrystalline, good induration, silicic cement, interbedded, 10% silt, 05% mica, calcareous.
12972-12973	Shale, pinkish gray, good induration, fissile, interbedded, 05% mica, silt.
12973-12974	Sandstone, pinkish gray, 05% porosity, intergranular, low permeability, grain size: very fine, range: very fine to microcrystalline, good induration, silicic cement, 10% mica.
12973-12974	Sandstone, pinkish gray, 05% porosity, intergranular, low permeability, grain size: very fine, range: very fine to microcrystalline, good induration, silicic cement, 10% mica.
12974-12975	Sandstone, greenish black, 05% porosity, intergranular, low permeability, grain size: very fine, range: very fine to microcrystalline, good induration, silicic cement interbedded, 05% mica, 05% silt, calcareous.
12975-12976	Sandstone, pinkish gray to greenish black, 05% porosity, intergranular, low permeability, grain size: very fine, range: microcrystalline to very fine, good induration, silicic cement, interbedded, 15% silt, 05% mica, calcareous.

12976-12977	Sandstone, pinkish gray, 05% porosity, intergranular, low permeability, grain size: very fine, range: microcrystalline to very fine, good induration, silicic cement, calcilutite matrix, interbedded, 05% mica, 15% silt, calcareous.
12977-12978	Sandstone, greenish black, 05% porosity, intergranular, low permeability, grain size: very fine, range: microcrystalline to very fine, good induration, silicic cement, calcilutite matrix, interbedded, 15% silt, 05% mica, calcareous.
12978-12979	Sandstone, greenish black, 05% porosity, intergranular, low permeability, grain size: very fine, range: microcrystalline to very fine, good induration, silicic cement, calcilutite matrix, interbedded, 15% silt, 05% mica, calcareous.
12979-12980	Silt, pinkish gray, porosity, none observed, good induration, silicic cement, fissile.
12980-12981	Silt, pinkish gray, porosity, none observed, good induration, silicic cement, fissile, 03% mica, 02% phosphatic gravel.
12981-12982	Sandstone, pinkish gray, porosity, none observed, grain size: very fine, range: microcrystalline to very fine, good induration, silicic cement, calcilutite matrix, fissile, interbedded, bedded, 03% mica, 02% phosphatic gravel, calcareous.
	DEAD OIL OR TAR
12980-12983	Silt, pinkish gray, porosity, none observed, good induration, fissile, interbedded, 05% mica, 01% phosphatic gravel, partings, calcareous.
12983-12984	Silt, pinkish gray, porosity, none observed, good induration, silicic cement, fissile.

12984-12985	Silt, pinkish gray, porosity, none observed, good induration, silicic cement, fissile, interbedded, 02% mica, 01% phosphatic gravel, 10% quartz sand, calcareous.
12985-12986	Silt, pinkish gray, porosity, none observed, good induration, silicic cement, fissile, interbedded, 02% mica, 01% phosphatic gravel, 10% quartz sand, calcareous.
12985-12986	Silt, pinkish gray, porosity, none observed, good induration, fissile.
12986-12987	Silt, pinkish gray, porosity, none observed, good induration, fissile.
12987-12988	Silt, pinkish gray, porosity, none observed, good induration, fissile, 02% mica.
12988-12890	Silt, pinkish gray, porosity, none observed, good induration, fissile, 02% mica.
12890-12990	Silt, pinkish gray, porosity, none observed, good induration, fissile, 02% mica.
12990-12991	As above.
12991-12995	Sandstone, dark reddish brown to dark gray, 05% porosity, intergranular, possibly high permeability, grain size: very fine, range: microcrystalline to fine, moderate induration, silicic cement, interbedded, 01% calcite, 02% mica, 80% iron stain.
12995-13000	Sandstone, dark reddish brown to dark gray, 05% porosity, intergranular, possibly high permeability, grain size: very fine, range: microcryustalline to fine, moderate induration, silicic cement, interbedded, 80% iron stain, 02% mica, 01% calcite.

10-15% Porosity in coarser sandstones. Some cuttings show iron stain contact with non stained sandstone.

13000-13010	Sandstone, dark reddish brown to dark gray, 05% porosity, intergranular, possibly high permeability, grain size: very fine, range: microcrystalline to medium, moderate induration, silicic cement, interbedded, fissile, 85% iron stain, 02% mica, 01% calcite, 03% limestone.
13010-13015	As above
13015-13020	As above
13020-13025	Sandstone, dark reddish brown to dark gray, 05% porosity, intergranular, possibly high permeability, grian size: very fine, range: microcrystalline to medium, moderate induration, silicic cement, interbedded, fissile, 85% iron stain, 02% mica, 10% quartz sand, 03% limestone.
13025-13030	Sandstone, dark reddish brown to dark gray, 05% porosity, intergranular, possibly high permeability, grain size: very fine, range: microcrystalline to fine, moderate induration, silicic cement, interbedded, fissile, 85% iron stain, 02% mica, 25% quartz sand, 03% limestone.
13030-13035	Sandstone, dark reddish brown to dark gray, 05% porosity, intergranular, possibly high permeability, grain size: very fine, range: microcrystalline to fine, moderate induration, silicic cement, interbedded, fissile, 85% iron stain, 02% mica, 05% quartz sand, 03% limestone.
13035-13040	Sandstone, dark reddish brown to dark gray, 05% porosity, intergranular, possibly high permeability, grain size: very fine, range: microcrystalline to medium, moderate induration, silicic

cement, interbedded, fissile, 75% iron stain, 02% mica, 01% quartz sand, 02% limestone.

13040-13045	As above
13045-13050	Sandstone, dark reddish brown to dark gray, 05% porosity, intergranular, possibly high permeability, grain size: very fine, range: microcrystalline to medium, moderate induration, silicic cement, interbedded, fissile, 80% iron stain, 02% mica, 01% quartz sand, 03% limestone.
13050-13055	Sandstone, dark reddish brown to dark gray, 05% porosity, intergranular, possibly high permeability, grain size: very fine, range: microcrystalline to medium, moderate induration, silicic cement, interbedded, fissile, 70% iron stain, 02% mica, 05% quartz sand, 01% limestone.
13055-13060	As above
13060-13065	Sandstone, blackish red to dark gray, 05% prosity intergranular, possibly high permeability, grain size: fine, range: microcrystalline to medium, moderate induration, silicic cement, interbedded, fissile, 70% iron stain, 02% mica, 05% quartz sand, 01% limestone.
13065-13070	Limestone, dark yellowish brown, grain type: crystals, oolite, pellet, moderate induration, sparry calcite cement, 65% quartz sand, 15% silt. Above interpretation based on first appearance of limestone.
13070-13075	Sandstone, dark reddish brown to dark gray, 05% porosity, intergranular, possibly high permeability, grain size: very fine, range: microcrystalline to fine, moderate induration, silicic cement, interbedded, fissile, 60% iron stain, 02% mica, 10% quartz sand.

13075-13080	Limestone, dark yellowish brown, grain type: crystals, oolite, range: microcrystalline to very fine, moderate induration, sparry calcite cement, 50% quartz sand, 20% silt.
13080-13085	As above
13085-13090	Silt, dark gray to dark reddish brown, moderate induration, silicic cement, interbedded, fissile, 50% iron stain, 02% mica, 10% limestone 20% quartz sand.
13090-13095	Silt, dark gray to dark reddish brown, moderate induration, silicic cement, interbedded, fissile, 40% iron stain, 02% mica, 05% limestone, 25% quartz sand.
13095-13100	Silt, dark gray to dark reddish brown, moderate induration, sparry clacite cement, interbedded, fissile, 50% iron stain, 02% mica, 03% limestone, 15% quartz sand, calcareous.
13100-13105	As above
13105-13110	As above
13110-13115	As above
13115-13120	Silt, dark gray to dark reddish brown, porosity, intergranular, possibly high permeability, moderate induration, silicic cement, interbedded, fissile, 40% iron stain, 02% mica, 01% limestone, 15% quartz sand.
13120-13125	As above
13125-13130	AS above
13130-13135	Limestone, dark yellowish brown, porosity, none observed, grain type: crystals, pellet, range: microcrystalline to very fine, moderate induration, sparry calcite cement, 50% quartz sand, 20% silt.

13135-13140	Silt, black to dark reddish brown, moderate induration, silicic cement, interbedded, fissile, 30% iron stain, 02% mica, 07% limestone, 15% quartz sand.
13140-13145	Silt, black to dark reddish brown, moderate induration, silicic cement, interbedded, fissile, 30% iron stain, 02% mica, 01% limestone, 10% quartz sand.
13145-13150	As above
13150-13155	Limestone, grayish brown to dark yellowish brown, 12% porosity, moldic, pin point vugs, intergranular, grain type: crystals, range: microcrystalline to very fine, moderate induration, sparry calcite cement, interbedded, 50% quartz sands, 20% silt, 10% iron stain, high recrystallization.
13155-13160	Silt, dark gray to dark reddish brown, moderate induration, silicic cement, interbedded, fissile, 30% iron stain, 02% mica, 01% limestone, 05% quartz sand.
13160-13165	Silt, dark gray to dark reddish brown, moderate induration, silicic cement, interbedded, fissile, 30% iron stain, 02% mica, 01% limestone, 05% quartz sand.
13165-13170	As above
13170-13175	As above
13175-13180	Silt, black to dark reddish brown, moderate induration, silicic cement, interbedded, fissile, 30% iron stain, 02% mica, 05% quartz sand.
13180-13185	Silt, black to dark reddish brown, moderate induration, silicic cement, interbedded, fissile, 20% iron stain, 02% mica, 05% quartz sand.
13185-13190	As above

13190-13195	Siltstone dark gray (N3) very fine grained, moderate indurated. Silica cement, fissile, micaceous (2%) with loose quartz sand (5%). Approximately 25% red siltstone - sandstone.
13195-13205	As above
13205-13210	Siltstone dark gray (N3) very fine with fine to medium grain clear to white to green (glauconite?) sandstone (5%), weakly indurated; conglomeratic in part. Approximately 15% red siltstone-sandstone.
13210-13220	Siltstone dark gray (N3) very fine grained with approximately 2% limestone (10 YR 2/2) moldic (10%) porosity pin-point vugular microcrystalline. Approximately 15% red siltstone-sandstone. Possible limestone bed.
13230-13235	Siltstone dark gray (N3) very fine grained with decreasing limestone. Approximately 15% red siltstone - sandstone.
13235-13240	Siltstone dark gray (N3) very fine grained with approximately 10% loose sand and greenish - white weakly indurated sandstone. Approximately 15% red siltstone - sandstone.
13240-13245	Siltstone dark gray (N3) very fine grained with increasing white - green (glauconite ? sandstone) and white-red fine to course grain conglomerate (10%). Approximately 15% red siltstone-sandstone.

13245-13250	As above.
13250-13255	Limestone dusky yellowish brown (10 YR 2/2) microcrystalline/fine grained. 10-20% oolitic?, moldic porosity pin - point, vugular; with above material. Approximately 15% red siltstone - sandstone. 5' lag on samples using sonic log.
13255-13260	Siltstone dark gray (N3) very fine grained, medium indurated silica cement slightly fissile, micrite (02%), limestone as above (03%). Approximately 15% red siltstone - sandstone.
13260-13265	Siltstone dark gray (N3) very fine grained, medium indurated silica cement slightly fissile, micrite (02%), limestone as above (03%). Approximately 10% red siltstone - sandstone.
13265-13270	As above.
13270-13275	Siltstone-sandstone dark gray (N3) very fine grained, medium indurated silica cement slightly fissile, micrite (02%), limestone as above (03%). With decreasing limestone, increasing white - clear quartz angular to subangular sandstone fine - course grain. Approximately 10% red siltstone - sandstone.
13275-13280	Siltstone - limestone dark gray (N3) very fine grained, medium indurated silica cement slightly fissile, micrite (02%), limestone as above (03%). Very small oolitic limestone, grainstone, moldic porosity approximately 1%. Approximately 10% red siltstone - sandstone.

13280-13285	Siltstone dark gray (N3) very fine grained, slightly fissile, mica (02%) with dense dark limestone (02-03%) and limestone as in 13250 - 13255. Approximately 10% red siltstone - sandstone.
13285-13290	Siltstone dark gray (N3) very fine grained, slightly fissile, mica (02%) with dense dark limestone (02-03%), and limestone as in 13250 - 13255. White - green sandstone fine to coarse grained - iron stained in parts, trace of limestone, green waxy siltstone? Approximately 10% red siltstone - sandstone. Healed fracture angular to fissility of gray siltstone.
13290-13295	Siltstone dark gray (N3) very fine grained, slightly fissile, mica (02%) with dense dark limestone (02-03%), and limestone as in 13250 -13255. White - green sandstone, fine to coarse grained - iron stained in parts, trace of dense dark limestone, green waxy siltstone? Approximately 10% red siltstone - sandstone. A few white - green sandstone chips have gray silt attached to them. Possibly indicating intercalated siltstone and sandstone.
13295-13300	Siltstone dark gray (N3) very fine grained, slightly fissile, mica (2%) with dense dark limestone (2-3%), and limestone as in 13250-13255. White - green sandstone, fine to coarse grained - iron stained in parts, trace of dense dark limestone, green waxy siltstone? Approximately 07% red siltstone - sandstone.
13300-13310	As above.

13310-13315	Siltstone dark gray (N3) very fine grained, slightly fissile, mica (02%) with dense dark limestone (02-03%), and limestone as in 13250 - 13255. White - green sandstone, fine to course grained - iron stained in parts, trace of dense dark limestone, green waxy siltstone? Approximately 05% red siltstone - sandstone.
13315-13320	As above.
13320-13325	Siltstone dark gray (N3) very fine grained, slightly fissile, mica (2%) with increasing white - green quartz sandstone (5-7%). Approximately 5% red siltstone - sandstone.
13325-13330	Siltstone dark gray (N3) very fine grained, slightly fissile, mica (02%) with decreasing sandstone, increasing dark (10 YR 2/2) dense limestone (02%). Approximately 03% red siltstone - sandstone. (ream-finely layered limestone.
13330-13335	Limestone dark yellowish brown to dusky yellowish brown (10 YR 4/2 - 10 YR 2/2) very fine grained, moderately indurated with siltstone dark gray fine grained. Dense. Approximately 03% red siltstone - sandstone. Lithology change.

CORE

13336-13337	Siltstone dark gray (N3) very fine grained and silty sands tone dark greenish gray (5 GY 2/1) very fine grained calcareous, thinly bedded (1-3mm). Dense.

13337-13337	Siltstone olive black (5 y 2/1) very fine grained with plant remains, appear as very shiny black replacement (?) tar (?) very slightly calcareous. Dense.
13338-13339	As above.
13339-13340	As above.
13340-13341	Sandstone greenish black (5 GY 2/1) fine grained with scattered plant? remains, slightly calcareous, well sorted, subrounded, slight micaceous. Dense. Tar(?).
13341-13342	Sandstone greenish black (5 GY 2/1) fine grained, well indurated, well sorted subrounded, slightly micaceous. Dense.
13343-13344	Sandstone dark greenish gray (5 GY 4/1) fine grained, well indurated, well sorted, slightly micaceous. Dense.
13344-13345	As above.
13345-13346	Siltstone olive black (5 y 2/1) very fine grained, with abundant plant? remains, well indurated. Dense. Tar?
13346-13347	Sandstone dark greenish gray (5 Gy 4/1) fine grained, well indurated, well sorted, slightly micaceous. Dense.
13347-13348	As above.
13348-13349	As above.
13349-13350	As above.
13350-13351	As above.

13351-13352	Siltstone olive black (5 y 2/1) very fine grained, abundant plant (?) remains. Dense. Tar(?)
13352-13353	Sandstone dark greenish gray (5 Gy 4/1) fine grained, well indurated, slight micaceous, slightly calcareous. Dense.
13353-13354	Siltstone olive black (5 y 2/1) very fine grained, abundant plant? remains, well indurated. Dense. Tar(?)
13354-13355	Sandstone dark greenish gray (5 Gy 4/1) fine grained, well indurated, slightly micaceous, slightly calcareous. Dense.
13355-13356	Siltstone olive black (5 y 2/1) very fine grained, with plant? remains, well indurated. Dense. Tar(?)
13356-13357	Limestone greenish black (5 G 2/1) very fine grained, very slightly, with plant remains?, very micaceous. Dense.
13357-13358	Siltstone greenish black (5 G 2/1) very fine grained, very micaceous, calcareous, well indurated. Looks like above sample. Dense.
13358-13359	Siltstone greenish black (5 Gy 2/1) very fine grained, very calcareous, well indurated as above. Dense.
13359-13360	Siltstone dark gray (N3) very fine grained, well indurated, slightly fissile, micaceous. Dense.
13360-13361	Sandstone greenish black (5 Gy 2/1) fine grained, slightly calcareous, well indurated, micaceous. Dense.

13361-13362	As above.
13362-13363	Sandstone greenish black (5 Gy 2/1) fine grained, very calcareous, well indurated, micaceous. Dense.
13363-13364	Sandstone greenish black (5 Gy 2/1) fine grained, slightly calcareous, slightly micaceous. Dense.
13364-13365	Sandstone greenish black (5 Gy 2/1) fine grained, slightly calcareous, slightly micaceous. 05% porosity.
13365-13366	Siltstone olive black (5 y 2/1) very fine grained, well indurated , very fissile, with thin streaks of above sandstone. Dense.
13366-13367	Siltstone olive black (5 y 2/1) very fine grained, with scattered plant(?) remains, abundant mica 03%. Dense. Tar(?)
13367-13368	Sandstone greenish black (5 Gy 2/1) fine grained and siltstone olive black (5 y 2/1) very fine grained, intercalated 4-5mm thick units as above. Very sharp contact. Dense.
13368-13369	Shaly siltstone olive black (5 y 2/1) very fine grained, well indurated, fissile. Thin streaks of very micaceous sandstone as above. Dense.
13369-13370	Limestone olive black (5 y 2/1) micrite, well indurated, thin layers of argillaceous material. Dense. Very low energy - tidal flat?
13370-13371	Siltstone olive black (5 y 2/1) very fine grained, well indurated, fissile, abundant mica (03%), plant(?) remains. Dense.

13371-13372	Sandstone greenish black (5 Gy 2/1) fine grained and siltstone olive black (5 y 2/1) very fine grained, intercalated, siltstone fissile, very micaceous, very fine grained, intercalated, siltstone fissile, very micaceous, very sharp contact. Sandstone 05% porosity, siltstone is dense.
13372-13373	Shaly siltstone olive black (5 y 2/1) fine grained and siltstone olive black
13365-13366	Siltstone olive black (5 y 2/1) very fine grained, well indurated , very fissile, with thin streaks of above sandstone. Dense.
13366-13367	Siltstone olive black (5 y 2/1) very fine grained, with scattered plant(?) remains, abundant mica 03%. Dense. Tar(?)
13367-13368	Sandstone greenish black (5 Gy 2/1) fine grained and siltstone olive black (5 y 2/1) very fine grained, intercalated 4-5mm thick units as above. Very sharp contact. Dense.
13368-13369	Shaly siltstone olive black (5 y 2/1) very fine grained, well indurated, fissile. Thin streaks of very micaceous sandstone as above. Dense.
13369-13370	Limestone olive black (5 y 2/1) micrite, well indurated, thin layers of argillaceous material. Dense. Very low energy - tidal flat?
13370-13371	Siltstone olive black (5 y 2/1) very fine grained, well indurated, fissile, abundant mica (03%), plant(?) remains. Dense.

13371-13372	Sandstone greenish black (5 Gy 2/1) fine grained and siltstone olive black (5 y 2/1) very fine grained, intercalated, siltstone fissile, very micaceous, very fine grained, intercalated, siltstone fissile, very micaceous, very sharp contact. Sandstone 05% porosity, siltstone is dense.
13372-13373	Shaly siltstone olive black (5 y 2/1) very fine grained, well indurated, very fissile, micaceous, very fine. 07% porosity.
13373-13374	Sandstone greenish black (5 Gy 2/1) fine grained and siltstone olive black (5 y 2/1) very fine grained, intercalated, well indurated, very micaceous (5-7%) course grained, plant remains. 07% porosity.
13374-13375	Siltstone olive black (5 y 2/1) very fine grained, well indurated, very micaceous (05-07%), scattered plant remains, sandy possibly intercalated sandstone and shale. 07% porosity.
13375-13376	Sandstone dark greenish gray (5 Gy 4/1) fine medium, medium indurated, slightly micaceous, well sorted, subrounded - subangular, very calcareous. 10% porosity.
13376-13377	As above.
13377-13378	Sandstone dark greenish gray (5 Gy 4/1) fine medium, poorly indurated, slightly micaceous, well sorted, subangular - subrounded, very calcareous. 10-15% porosity.
13378-13379	As above.
13379-13380	As above.

13380-13381	As above.
13381-13382	As above.
13382-13383	As above.
13383-13384	Shale olive black (5 y 2/1) microcrystalline, well indurated, abundant plant remains, abundant mica (02-03%), very fissile. Dense. Tar(?)
13384-13385	Siltstone dark gray (N3) very fine grained and sandstone olive black (5 y 2/1) very fine grained, well indurated, scattered plant remains, abundant mica (02-03%), inter-calated with fine medium grained sandstone. Dense.
13385-13386	Siltstone dark gray (N3) very fine grained and sandstone greenish black (5 G 2/1) fine medium, inter-calated as above with abundant plant (?) remains in siltstone and abundant mica. Dense.
13386-13387	Siltstone olive black (5 y 2/1) very fine grained, well indurated, very micaceous, scattered plants?, slightly fissile. Dense.
13387-13388	Sandstone dark greenish gray (5 Gy 4/1) fine medium, medium indurated, well sorted, subrounded - subangular. 07% porosity.
13388-13389	Sandstone greenish black (5 G 2/1) fine medium, medium indurated, well sorted, subrounded - subangular, scattered plant(?) remains, very micaceous. 05% porosity.
13389-13390	Siltstone olive black (5 y 2/1) very fine grained, well indurated, micaceous, slightly fissile, scattered plants(?) Dense.

13390-13391	Sandstone olive black (5 y 2/1) fine grained, well indurated, slightly micaceous, slightly calcareous. Dense.
13391-13392	Siltstone olive black (5 y 2/1) very fine grained, well indurated, slightly micaceous, scattered plants? Dense.
END CORE	
13395-13400	Siltstone olive black (5 y 2/1) very fine grained, well indurated, slightly micaceous with plant remians in some cuttings. Dense. Approximately 10% red siltstone - sandstone.
13400-13405	Siltstone olive black (5 y 2/1) very fine grained, well indurated, slightly micaceous with plant remains in some cuttings. Scattered limestone, dense, dusky yellowish brown (10 YR 2/2) and loose sand.
13405-13410	Siltstone olive black (5 Y 2/1) very fine grained and sandstone dark greenish gray (5 Y 2/1) fine medium grained, intercalated sandstone and siltstone as in core 13385-13386. Approximately 10% red siltstone - sandstone.
13410-13415	Siltstone olive black (5 Y 2/1) very fine grained and sandstone dark greenish gray (5 Gy 4/1) fine medium grained, intercalated sandstone and siltstone as in core 13385 - 13386. Approximately 07% red siltstone - sandstone.
13415-13420	Sandstone dark greenish gray (5 Gy 4/1) fine medium grained, medium indurated, well sorted, subrounded to angular with 70% siltstone as above. 10% porosity. Approximately 05% red siltstone - sandstone.

13420-13425	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine grained, hard, few fragments - very thin layered limestone with 80% siltstone as above. Dense. Approximately 05% red siltstone - sandstone.
13425-13430	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine grained, hard, few fragments - very thin layered limestone with 60% siltstone as above. Dense. Approximately 05% red siltstone - sandstone. Intertidal(?)
13430-13435	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine grained, hard with abundant thin layered limestone argillaceous, with 60% siltstone as above. Dense. Approximately 5% red siltstone - sandstone.
13435-13440	Siltstone olive black (5 Y 2/1) very fine grained, well indurated, slight very fine mica. Dense. Approximately 07% red siltstone - sandstone.
13340-13345	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (01 YR 2/2) very fine crystalline, hard with chips showing thin argillaceous layers 60-75% gray siltstone. Dense. Approximately 15% red siltstone - sandstone. This sequence appears to be interbedded limestone and siltstone.
13445-13450	As above.
13450-13455	Siltstone olive black (5 Y 2/1) very fine grained and limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine crystalline, interbedded

	limestone and siltstone as above (01-03%), could be porous, very fine crystalline dolomite, 5-10% loose quartz sand, 60-75% gray siltstone. Approximately 01-05% porosity. Approximately 15% red siltstone - sandstone.
13455-13460	Siltstone olive black (5 Y 2/1) very fine grained and limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine crystalline, interbedded limestone and limestone with argillaceous layers and very fine crystalline dolomite? 75% gray siltstone. Approximately 15% red siltstone to sandstone.
13460-13465	As above.
13465-13470	Siltstone olive black (5 Y 2/1) very fine grained and limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine crystalline, interbedded limestone and limestone with argillaceous layers and very fine crystalline dolomite? 65% gray siltstone. Dense porosity. Approximately 20% red siltstone to sandstone.
13470-13475	Siltstone olive black (5 Y 2/1) very fine grained and limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine crystalline, interbedded limestone and limestone with argillaceous layers and very fine crystalline dolomite? 65% gray siltstone. Dense. Approximately 15% red siltstone - sandstone.
13475-13480	Siltstone olive black (5 Y 2/1) very fine grained and limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very

fine crystalline, interbedded limestone and limestone with argillaceous layers and very fine crystalline dolomite? 75% gray siltstone. Dense. Approximately 10% red siltstone - sandstone.

13480-13485	Siltstone olive black (5 Y 2/1) very fine grained, hard, well indurated, scattered limestone as above; sandstone dark greenish gray (5 GY 4/1) as above, loose quartz sand. 65% gray siltstone. Dense. Approximately 15% red siltstone - sandstone.
13485-14390	Sandstone olive gray (5 Y 4/1) fine medium grained, medium indurated, well sorted, 5% dense limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) as above. 60% gray siltstone. Dense. Approximately 15% red siltstone - sandstone.
13490-13495	Siltstone olive black (5 Y 2/1) very fine grained, hard, well indurated, micaceous with limestone (01-03%) as above, loose quartz sand. 75% gray siltstone. Dense. Approximately 10% red siltstone - sandstone.
13495-13500	Sandstone olive gray (5 Y 4/1) fine medium grained, medium indurated, well sorted, subangular to rounded withs siltstone as above. 65% gray siltstone. Approximately 7% red siltstone - sandstone.
13500-13505	Sandstone olive gray (5 Y 4/1) fine medium grained, sandstone as above with 10-15% loose clear quartz sand. 50% gray siltstone. Approximately 10% red siltstone - sandstone. Coal(?) Very shiny arthrocite(?) Became very brittle when heated.

13505-13510	Siltstone olive black (5 Y 2/1) very fine grained, hard, well indurated, micaceous, interbedded with limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2). Dense, abundant loose sand as above. Approximately 10% red siltstone - sandstone.
13510-13515	Siltstone olive black (5 Y 2/1) very fine grained, hard well indurated, micaceous, interbedded with limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2). Dense, abundant loose sand as above. Approximately 10-15% red siltstone - sandstone.
13515-13520	Siltstone olive black (5 Y 2/2) very fine grained and sandstone olive gray (5 Y 4/1) fine to course grained, interbedded as above, abundant course sand. Approximatley 10-15% red siltstone - sandstone. <u>Top norphlet</u>.
13520-13525	Siltstone olive black (5 Y 2/2) very fine crystalline and limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine crystalline, siltstone as above with limestone, moldic porosity, pin-point, and very dense limestone. Approximately 18% porosity (formation density neutron compensated log). Approximately 10-15% red siltstone - sandstone. <u>Possible limestone bed very porous</u>.
13525-13530	Sandstone olive gray (5 Y 4/1) and clear fine to coarse grained, medium to poorly indurated, abundant loose sand. 40-50% siltstone as above. 1-2% liemstone. Dense. Approximately 25% red siltstone - sandstone.

13530-13535	Sandstone olive gray (5 Y 4/1) and dusky brown (5 YR 2/2) fine to coarse grained, abundant loose sand, increasing red - brown sandstone and shale. Approximately 25% red siltstone - sandstone.
13535-13540	Sandstone dark greenish gray (5 GY 4/1) and clear fine to coarse grained, abundant loose sand, very (potash-feldspar), subrounded to angular, poorly sorted? 15-20% porosity. Approximately 30% red siltstone - sandstone. Similar to first foot of core (Norphlet) on 846 well.
13540-13545	Sandstone dark greenish gray (5 GY 4/1) and clear fine to coarse grained, abundant clear, red loose sand, white to red sandstone, high porosity, and greenish (5 GY 4/1)? sandstone. 15-20% porosity. Approximately 30% red siltstone - sandstone.
13545-13550	Sandstone dusky brown (5 YR 2/2) fine to coarse grained and siltstone dusky brown (5 YR 2/2) very fine grained, red to brown, increasing with as above and dusky brown (5 YR 2/2) and dusky yellowish brown (10 YR 2/2) limestone dense with very fine crystalline, high porosity limestone. Approximately 40% red siltstone - sandstone.
13550-13555	Siltstone and shale dusky brown (5 YR 2/2) very fine grained and porous, hard fissile with above. Approximately 40% red siltstone - sandstone.
13555-13560	Siltstone and shale dusky brown (5 YR 2/2) very fine grained and porous, hard fissile with above,

	abundant loose sand fine to coarse grained. Approximately 50% red siltstone - sandstone.
13560-13565	As above.
13565-13570	Siltstone and shale dusky brown (5 YR 2/2) very fine grained and porous, hard fissile with above, abundant lose sand fine to coarse grained. with very thin bedded layered limestone and clear to red sandstone fine medium grained, 10-15% porosity. Approximately 60% red siltstone - sandstone.
13570-13575	As above.
13575-13580	Siltstone and shale dusky brown (5 YR 2/2) very fine grained and porous, hard fissile, decreasing loose sand, very thin layered limestone, increasing sandstone clear to red fine to medium grained, 10-15% porosity. Approximately 60% red siltstone - sandstone.
13580-13585	Sandstone clear to red fine to coarse grained, medium indurated, angular to subrounded glauconite? with above. 15-20% porosity. Approximately 50% red siltstone - sandstone.
13585-13590	Sandstone clear to red fine to coarse grained, medium induration, angular to subrounded glauconite? increasing potash - feldspar, 5% dense very fine crystalline limestone and finely layered limestone. 20-25% porosity.
13590-13595	Sandstone clear to red fine to coarse grained, moderately indurated, angular to subrounded glauconite? very poorly sorted. 20-25% porosity.

13595-13600	Sandstone clear to red fine to coarse grained, moderately indurated, angular to subrounded glauconite? 30% porosity.
13600-13620	No sample.
13620-13630	Siltstone and shale dusky brown (5 YR 2/2) very fine grained and porous, hard fissile, minor sandstone as above, 60% gray siltstone. Dense. Approximately 25% red siltstone - sandstone.
13630-13640	As above.
13640-13650	Sandstone clear to red fine to coarse grained, moderately indurated, poorly sorted, angular to subrounded. 50% gray siltstone. Approximately 35% red siltstone - sandstone. Trace of coal.
13650-13660	Sandstone dusky brown (5 YR 2/2) fine to coarse grained and siltstone moderate brown (5 YR 3/4) very fine grained, interbedded as above. Approximately 35% red siltstone - sandstone.
13660-13670	Sandstone clear to red fine to very coarse grained, abundant potash - feldspar: looks like very fresh arkosic sand. 45% gray siltstone. 15-30% porosity. Approximately 25% red siltstone - sandstone.
13670-13680	Sandstone clear to red fine to very coarse grained, abundant arkosic sand potash - feldspar as above. 40% gray siltstone. Approximately 20% red siltstone - sandstone.
13680-13690	As above.
13690-13700	Siltstone and shale olive black (5 Y 2/1) very fine grained, gray dense well indurated with arkosic

	sand as above. 80% gray siltstone. Approximately 10% red siltstone - sandstone.
13700-13710	Sandstone clear to red fine to very coarse grained abundant arkosic sand 20%. 65% gray siltstone. Approximately 15% red siltstone - sandstone.
13710-13720	Sandstone clear to red fine to very coarse grained, gray dense well indurated with arkosic sand as above. 80% gray siltstone. Approximately 10% red siltstone - sandstone.
13700-13710	Sandstone clear to red fine to very coarse grained abundant arkosic sand 20%. 65% gray siltstone. Approximately 15% red siltstone-sandstone.
13710-13720	Sandstone clear to red fine to very coarse grained, arkosic sand 10%, 70% gray siltstone. Approximately 20% red siltstone - sandstone.
13720-13730	Sandstone clear fine to very coarse grained and siltstone moderate brown (5 YR 3/4) very fine grained, interbedded as above 1-3% limestone. 60% gray siltstone. Approximately 30% red siltstone - sandstone.
13730-13740	Sandstone clear to red fine to very coarse grained, moderately indurated (potash-feldspar), 1-3% limestone, 50% gray siltstone. Approximately 30% red siltstone - sandstone.
13740-13750	Sandstone clear to red fine to very coarse grained, moderately indurated 20% potash - feldspar. 30% gray siltstone. Approximately 50% red siltstone - sandstone.

13750-13760	Siltstone olive black (5 Y 2/1) very fine grained, dense well indurated with abundant loose sand and wash as above, slightly micaceous. 50% gray siltstone. Approximately 40% red siltstone - sandstone.
13760-13770	Siltstone olive black (5 Y 2/1) very fine grained, dense well indurated slightly micaceous, increasing brown sandstone. 40% gray siltstone. Approximately 50% red siltstone - sandstone.
13770-13780	Sandstone clear to red fine to very corse grained, abundant granite wash (20-25%) very fresh angular. 40% gray siltstone. Approximately 30% red siltstone - sandstone. Top Louann 13777 Borehole compensated sonic log.
13780-T.D.	Sandstone clear to red fine to very course grained, abundant arkosic sand (20-25%) very fresh angular, chert; in salt, 100%.

MESA PETROLEUM CO.

#1 Buckeye Cellulose
Permit 960 Franklin County

12190-12200	Sandstone dark reddish brown (10 R 3/4) to dusky red (10 R 2/2) fine to medium grain. Moderate induration; well sorted, micaceous in part (sample contaminated with large mica plates)....95% red sandstone and siltstone. In Haynesville.
12200-12210	Sandstone transparent (R 8) medium to coarse grain and dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to medium grain. As above with poorly indurated quartz sandstone (30%). Less than 1% arkosic sands weathered. 70% red sandstand and siltstone.
1-210-12220	Sandstone as above and siltstone black (N 1) to olive black (5 Y 2/1). As above with 5% gray siltstone; moderate induration, slightly micaceous, slightly fissile. 85% red sandstone and siltstone.
12220-12230	As above with less than 1% gray siltstone. 90% red sandstone and siltstone.
12230-12240	Sandstone transparent medium to coarse grain. Poorly indurated quartz sandstone (30%). Greenish sandstone with iron-stain contact. Less than 1% gray siltstone and dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) sandstone and siltstone as above. 70% red sandstone and siltstone.

12240-12246	Siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) and sandstone transparent medium to coarse grain. As above. 70% red sandstone and siltstone.

Core Descriptions

12246-12247	Shale and siltstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) very fine grain. Well indurated, fissile. Dense.
12247-12248	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine grain to micrite. Well indurated, very silty dark mineral. Argillaceous. Dense.
12248-12249	Sandy limestone to sandstone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) very fine to medium grain. Very thinly layered clay? Sandy to silty dark mineral. Argillaceous. Dense.
12249-12250	Siltstone and sandstone very dusky red (10 R 2/2) very fine grain. Moderate induration, very fissile, interbedded with sandstone.
12250-12251	Siltstone and sandstone very dusky red (10 R 2/2) very fine grain. Well indurated, very finely micaceous. Dense.
12251-12252	As above.
12252-12253	As above.
12253-12254	As above.
12254-12255	Sandstone greenish gray (5 GY 6/1) fine to medium grain. Well sorted quartz - heavy mineral? Greenish glauconite? Very slightly calcareous cement. Approximately 10% porosity.

12255-12256	As above with black streaks plant material? Argillaceous?
12256-12257	Siltstone very dusky red (10 R 2/2) and sandstone dark reddish brown (10 R 3/4) very fine to fine grain. Interbedded, very thinly - 2-3 mm. Fissile.
12257-12258	Siltstone olive black (5 Y 2/1) very fine grain. Moderate induration with thin 1-2 mm sandstone layer.
12258-12259	Sandstone fine to medium grain and siltstone very fine grain very dusky red (10 R 2/2). Moderate to well indurated sandstone with siltstone layers.
12259012260	Sandstone medium dark gray (N 4) fine to medium grain. Moderate induration, well sorted. Dark heavy mineral? Quartz contact with red siltstone. Slightly calcareous. Approximately 10% porosity.
12260-12261	As above. Approximately 10-15% porosity.
12261-12262	As above. 13% porosity.
12262-12263	As above with large very dusky red (10 R 2/2) siltstone intraclasts. 10% porosity.
12263-12264	As above with few 1-2 mm very dusky red (10 R 2/2) siltstone intraclast. Slightly calcareous. 13% porosity.
12264-12265	Sandstone medium dark gray (N 4) and siltstone dark gray (N 3) very fine to fine grain. As above; slightly fissile, very finely micaceous. Dense.
12265-12266	Sandstone greenish gray (5 GY 6/1) and dark greenish gray (5 GY 4/1) fine to medium grain. Moderate induration, well sorted quartz sandstone, slightly calcareous glauconite. 13% porosity.

12266-12267 Sandstone dark greenish gray (5 GY 4/1) and greenish black (5 GY 2/1) fine grain. Moderate induration, well sorted quartz sandstone, very finely micaceous. Dissiminated black tar like plant? Less than 10% porosity.

12267-12268 As above, contact with siltstone as above (12264-65) very micaceous, interbedded. Less than 10% porosity.

12268-12269 Sandstone greenish gray (5 GY 6/1) and dark greenish gray (5 GY 4/1) fine to medium grain. Moderate induration, well sorted quartz sandstone, slightly calcareous - glauconite? Less than 10% porosity.

12269-12270 Sandstone dark greenish gray(5 GY 4/1) and greenish black (5 GY 2/1) fine grain. As above. Large plant like material. Some pyrite. Less than 10% porosity.

12270-12271 Sandstone greenish gray (5 GY 6/1) and dark greenish gray (5 GY 2/1) fine to medium grain. Moderate induration, well sorted; abundant green mineral glauconite? Quartz dark mineral streaks shale medium dark gray (N 4). 13% porosity.

12271-12272 Siltstone medium dark gray (N 4) very fine grain and sandstone dark greenish gray (5 GY 4/1) to greenish black (5 GY 2/1) fine to medium grain. Sandstone as above (3-5 mm) interbedded with medium dark gray (N 4) siltstone, finely micaceous. Very thin layers. Sandstone approximately 10% porosity.

12272-12273 Siltstone dark gray (N 3) to black (N 1) very fine grain. Moderate induration, slightly fissile, very finely micaceous.

12273-12274	Siltstone dark gray (N 3) very fine grain and sandstone dark greenish gray (5 GY 4/1) fine grain. Thinly bedded as above 3-5 mm.
12274-12275	As above, very fissile. Sandstone 7% porosity.
12275-12276	Sandstone dark greenish gray (5 GY 4/1) to greenish black (5 GY 2/1) fine to medium grain. Moderate to poor induration, slightly calcareous, well sorted. 15% porosity.
12276-12277	As above with a trace of plant remains.
12277-12278	As above.
12278-12279	Siltstone dark gray (N 3) very fine grain. Well indurated, very finely micaceous, slightly fissile. Dense.
12279-12280	Sandstone dark greenish gray (5 GY 4/1) to greenish black (5 GY 2/1) fine to medium grain. Moderate induration. Contact with dark gray (N 3) siltstone, micaceous. Approximately 10% porosity.
12280-12281	As above.
12281-12282	Sandstone dark greenish gray (5 GY 4/1) to greenish black (5 GY 2/1) fine to medium grain, and siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain. As above; large plant? remains, pyratized.
12282-12283	As above.
12283-12284	Limestone dusky yellowish brown (10 YR 2/2) to dark gray (N 3) fine grain. Crystalline, well indurated, sandy? Dense.
12284-12285	As above with fine less than 1 mm layers, argillaceous material? Dense.

12285-12286 Calcareous sandstone fine grain and sandstone fine to medium grain dusky yellowish brown (10 YR 2/2) to greenish gray (5 GY 6/1). Calcareous sandstone dusky yellowish brown (10 YR 2/2) in contact with greenish gray (5 GY 6/1) sandstone, well sorted. 10% porosity.

12286-12287 Limestone medium dark gray (N 4) to greenish gray (5 GY 6/1) fine grain. Hard, well indurated, sandy? Abundant plant remains. Approximately 10% porosity.

12287-12288 Sandstone dark greenish gray (5 GY 4/1) to greenish black (5 GY 2/1) fine grain. Moderate to well indurated with plant remains.

12288-12290 No sample.

<u>End Core Descriptions</u>

12290-12295 Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain. Moderate induration, very finely micaceous, slightly fissile? (approximately 1%) and 3-4% transparent sandstone fine to medium grain. 95% red sandstone and siltstone.

12295-12300 As above with an increase of 7-10%, approximately 5% sandstone as above. 85% red sandstone and siltstone.

12300-12305 Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain, and sandstone dark greenish gray (5 GY 4/1) fine to medium grain. As above, approximately 10-15% approximately10% sandstone as above. Coal-tar (shiny), 75% red sandstone and siltstone.

12305-12310 Sandstone dark greenish gray (5 GY 4/1) fine to medium grain, and siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain.

	Moderate to poor induration, well sorted with siltstone as above and approximately 10% transparent sandstone fine to medium grain. Coal-tar (shiny). 75% red sandstone and siltstone.
12310-12315	Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain and sandstone dark greenish gray (5 GY 4/1) fine to medium grain. As above approximately 25%. Decrease approximately 5%. 70% red sandstone and siltstone.
12315-12320	As above approximately 30% with approximately 5% sandstone transparent fine to medium grain. Well sorted? 70% red sandstone and siltstone.
12320-12325	As above approximately 40%. 50-60% red sandstone and siltstone.
12325-12330	As above approximately 40% with 10% sandstone clear fine to medium grain, well sorted? 50% red sandstone and siltstone.
12330-12335	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) fine grain to micrite. Well indurated with as above; recrystalline? Dense? 30% red sandstone and siltstone.
12335-12340	Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain, and sandstone dark greenish gray (5 GY-4/1) fine grain. Moderate induration, very finely micaceous with limestone (5-7%) as above. 30% red sandstone and siltstone.
12340-12345	As above. Limestone approximately 10%. Very fine crystalline dolomite - silty. 15-20% red sandstone and siltstone.
12345-12350	As above. 20% red sandstone and siltstone.

12350-12355	As above. Increase in silty limestone? Very calcareous sandstone 10-15%. 20% red sandstone and siltstone.
12355-12360	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2). Calcilulite? very silty, crystalline microspar?, with sandstone and siltstone as 12335-340. 40% red sandstone and siltstone.
12360-12365	Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain. Moderate induration, very finely micaceous. Increase in red sandstone and siltstone. Less than 5% limestone as above. 40% red sandstone and siltstone.
12365-12370	As above. Increase in medium to coarse grain clear sandstone. Limestone as above. Less than 1% coarse grain mica. 40% red sandstone and siltstone.
12370-12375	As above. 40% red sandstone and siltstone.
12375-12380	As above. Slight increase in limestone very fine to microspar? 25% red sandstone and siltstone.
12380-12385	Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain, and sandstone olive gray (5 Y 4/1) fine grain. As above increase in calcareous sandstone, silty limestone, slightly glauconite, well sorted, micaceous. 15-20% red sandstone and siltstone.
12385-12390	As above with calcareous sandstone, micaceous.
12390-12395	As above; slight decrease in silty limestone.
12395-12400	As above.
12400-12405	As above. 30% red sandstone and siltstone.

12405-12410	As above. 35% red sandstone and siltstone.
12410-12415	As above with hard dense limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) and very calcareous sandstone fine grain; micaceous coarse grain. 40% red sandstone and siltstone.
12415-12420	As above; decrease in calcareous sandstone; increase in fine to medium grain clear sandstone. Micaceous coarse grain. 30% red sandstone and siltstone.
12420-12425	As above.
12425-12430	As above; increasing glauconite sandstone fire grain porosity? 30% red sandstone and siltstone.
12430-12435	Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain. As above with silty limestone - calcareous sandstone. 30% red sandstone and siltstone.
12435-12440	As above. Less than 5% calcareous sandstone; micaceous. 20% red sandstone and siltstone.
12440-12445	As above. 20% red sandstone and siltstone.
12445-12450	Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain, and sandstone olive gray (5 Y 4/1) fine grain. As above, slight increase in sandstone - glauconite? 15% red sandstone and siltstone.
12450-12455	As above with 1-3% hard dense dusky yellowish brown (10 YR 2/2) to dusky brown (5 YR 2/2) limestone microspar? 20% red sandstone and siltstone.
12455-12460	As above.
12460-12465	As above.

12465-12470	Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain. Moderate induration, slightly fissile, very finely micaceous. Mica coarse grain. Lost circulation? 10% red sandstone and siltstone.
12470-12475	As above. Increase 40% dusky brown (5 YR 2/2) siltstone. 50% red sandstone and siltstone, in place?
12475-12480	As above; decrease in dusky brown (5 YR 2/2) siltstone. Approximately 10-15% red sandstone and siltstone.
12480-12485	Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain, and sandstone olive gray (5 Y 4/1) fine grain. Moderate induration, fussile, very finely micaceous - fine grain sandstone glauconite? 40% red sandstone and siltstone.
12485-12490	Siltstone medium dark gray (N 4) to dark gray (N 3) and dusky brown (5 YR 2/2) very fine grain. As 12475 dark brown siltstone. 40% red sandstone and siltstone.
12490-12495	Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain, and sandstone olive gray (5 Y 4/1) fine grain. Siltstone as above. Less than 1% brown siltstone. Trace of pyrite. 10% red sandstone and siltstone.
12495-12500	As above with abundant red to brown fine grain sandstone. 20% red sandstone and siltstone.
12500-12505	As above. 20% red sandstone and siltstone.
12505-12510	As above with 1-2% limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) hard dense microspar? 20% red sandstone and siltstone.

12510-12515	Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain. As above. 20% red sandstone and siltstone.
12515-12520	As above with abundant 10% olive gray (5 Y 4/1) sandstone. 10-15% dusky brown (5 YR 2/2) siltstone. 30% red sandstone and siltstone.
12520-12525	Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain, and sandstone olive gray (5 Y 4/1) fine grain. As above; sandstone glauconite. Less than 10% red sandstone and siltstone.
12525-12530	As above with limestone dusky brown (5 YR 2/2). Less than 1%. 10% red sandstone and siltstone.
12530-12535	As above. 10% red sandstone and siltstone.
12535-12540	As above. (Greenish to white sandstone with iron stain contact.) 10% red sandstone and siltstone.
12540-12545	As above. Some chips resemble core in 957 (thinly bedded siltstone to sandstone). 10% red sandstone and siltstone.
12545-12550	As above. Trace of pyrite. 25% red sandstone and siltstone.
12550-12555	As above with limestone dusky brown (5 YR 2/2) dense, approximately 1-2%. 10% red sandstone and siltstone.
12555-12560	As above. 15% red sandstone and siltstone.
12560-12565	As above. 10% red sandstone and siltstone.
12565-12570	As above. Increase in sandstone fine grain glauconite? Less than 1% limestone. 10% red sandstone and siltstone.

12570-12575	As above. Less than 10% red sandstone and siltstone.
12575-12580	As above. 10% red sandstone and siltstone.
12580-12585	As above. Increase in sandstone. 10% red sandstone and siltstone.
12585-12590	As above. Increase in transparent (5 R 8/2) to translucent (5 R 6/2) sandstone. 15% red sandstone and siltstone.
12590-12595	As above. Increase in olive gray (5 Y 4/1) sandstone.
12595-12600	As above.
12600-12605	Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain, and sandstone olive gray (5 Y 4/1) fine grain. Moderate induration, very finely micaceous with sandstone glauconite fine grain plant? 5% red sandstone and siltstone.
12605-12610	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) microspar to very fine grain. Hard dense with above. 10% red sandstone and siltstone.
12610-12615	Siltstone medium dark gray (N 4) to dark gray (N 3) very fine grain and sandstone olive gray (5 Y 4/1) fine grain. Moderate induration, very finely micaceous with glauconite fine to medium grain sandstone. 10% red sandstone and siltstone.
12615-12620	As above. Some chips very micaceous. 10% red sandstone and siltstone.
12620-12625	As above. 5% red sandstone and siltstone.
12625-12630	As above. Increase in dark brown siltstone. Less than 5% red sandstone and siltstone.

12630-12635	As above. Increase in sandstone. Less than 5% red sandstone and siltstone.
12635-12640	As above. Less than 5% red sandstone and siltstone.
12640-12645	As above. Increase in siltstone with less than 1% limestone dark, dense - 10-15% dark brown siltstone. 15% red sandstone and siltstone.
12645-12650	As above. Less than 5% red sandstone and siltstone.
12650-12655	As above. 10% red sandstone and siltstone.
12655-12660	Limestone dusky brown (5 YR 2/2) to dusky yellowish brown (10 YR 2/2) microspar to very fine grain. Hard dense recrystallized. with as above. 10% red sandstone and siltstone. Chalky limestone.
12660-12665	As above.
12665-12670	As above with very fine grain, very thinly bedded limestone interbedded with light brownish gray (5 YR 6/1) siltstone as above.
12670-12675	As above.

Core Descriptions

12679-12680	Sandstone moderate brown (5 YR 3/4) medium to coarse grain. Poorly cemented, slightly calcareous, subrounded to rounded, well sorted. 15-25% porosity.
12680-12726	As above.
12730-12740	As above. Loose sand with 70% cavings. 15-25% porosity.

12740-12750	Sandstone and sand clear to moderate brown (5 YR 3/4) fine to very coarse grain. Unconsolidated quartz sand, probably weakly cemented as core. 30-40% gray sandstone and siltstone.
12750-12760	As core. 25% gray sandstone and siltstone.
12760-12770	As core.
12770-12780	As core with scattered very coarse grain quartz. 15% gray sandstone and siltstone.
12780-12790	As above. 10% gray sandstone and siltstone.
12790-12800	As above. 10% gray sandstone and siltstone.
12800-12810	As above.
12810-12820	As above.
12820-12886	As above.
12886	Total depth.

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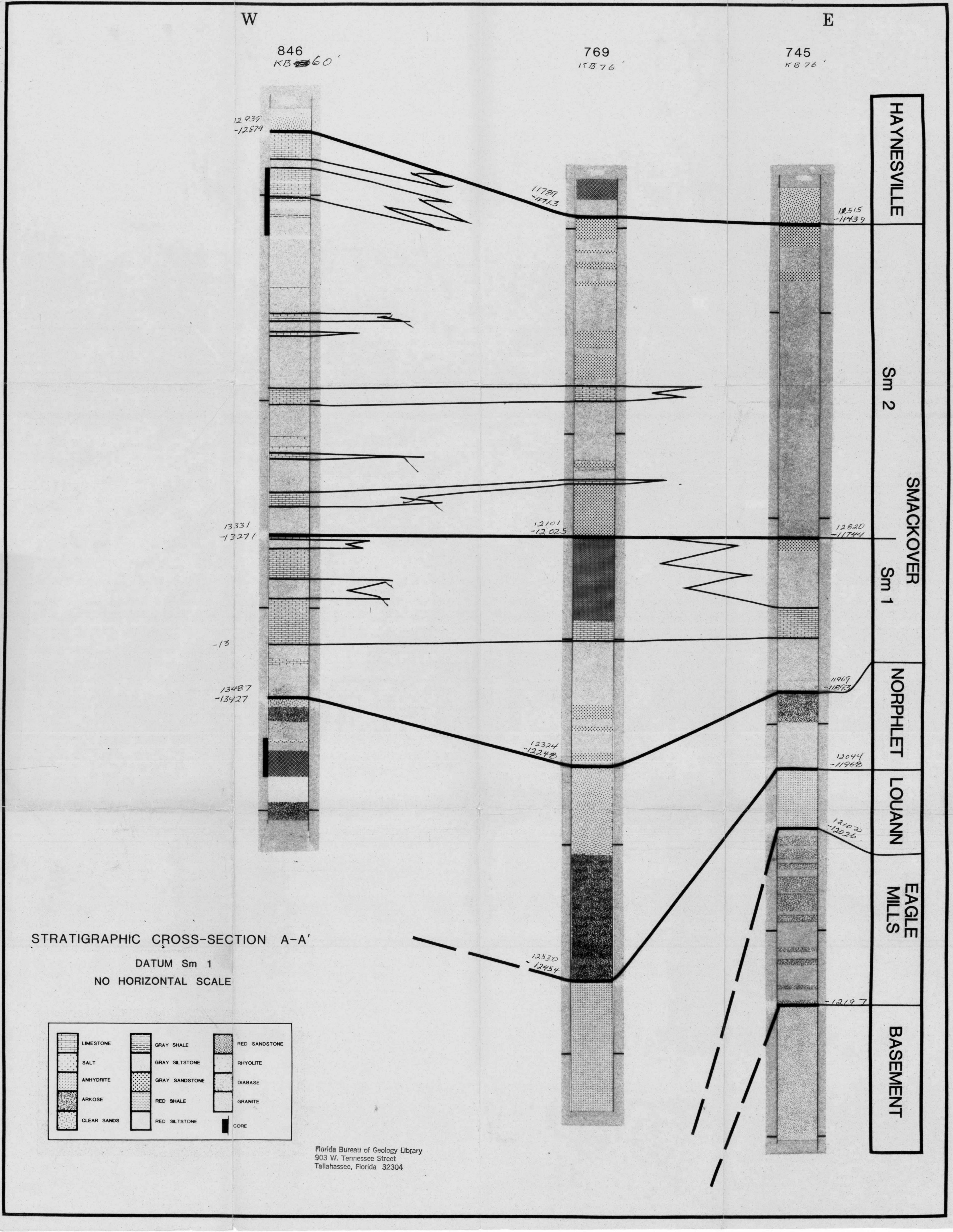
11600-11610	Siltstone to sandstone with sand dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) and clear very fine to medium to coarse grain. Sand loose quartz grains angular to subrounded with abundant orange potash-feldspar? 60% red sandstone and siltstone. Samples very finely cut.
11610-11620	As above with approximately 5-7% plant material? Coal? 60% red sandstone and siltstone. No gray lithology.
11620-11630	As above. Less than 1% plant material. Trace of light brownish gray (5 YR 6/1) siltstone. 60% red sandstone and siltstone.
11630-11640	As above. Trace of coal. 60% red sandstone and siltstone.
11640-11650	As above with yellowish gray (5 Y 8/1) to light olive gray (5 Y 6/1) fine grain sandstone. Poor induration. 60% red sandstone and siltstone.
11650-11660	As above. Trace of weathered Plagioclase and quartz (x-ray). 60% red sandstone and siltstone.
11660-11670	As above.

11670-11680	As above. 75% red sandstone and siltstone.
11680-11690	As above with 1-2% light gray sandstone. 75% red sandstone and siltstone.
11690-11700	As above. Abundant arkosic material. 75% red sandstone and siltstone.
11700-11710	As above with 1-2% light gray sandstone, calcareous. 75% red sandstone and siltstone.
11710-11720	As above. 75% red sandstone and siltstone.
11720-11730	As above. Trace of calcite veins? 75% red sandstone and siltstone.
11730-11740	As above. 75% red sandstone and siltstone.
11740-11750	As above with a trace of coal plant material?
11750-11760	As above. 75% red sandstone and siltstone.
11760-11770	As above, increase in loose sand, some iron stained angular to subrounded. 3-5% potash-feldspar. 50% red sandstone and siltstone. Lithology change.
11770-11780	As above. 50% red sandstone and siltstone.
11780-11790	As above. 50% red sandstone and siltstone.
11790-11800	As above with a trace of plant-coal? 50% red sandstone and siltstone.
11800-11810	As above with an increase in potash-feldspar, 5-7% (very fine white weathered plag and quartz (x-ray)) coal? 50% red sandstone and siltstone.
11810-11820	As above.

11820-11830	Sandstone dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine grain. Moderate induration, slightly micaceous. Less than 1% green waxy siltstone, some iron-stained contact. Less than 1% dusky brown (5 YR 2/2) limestone crystalline. Trace of very fine white weathered plag and quartz (x-ray). 90% red sandstone and siltstone. Drill cut larger.
11830-11840	As above. 80% red sandstone and siltstone.
11840-11850	Conglomerate clear fine to coarse grain. As above with calcareous cement conglomerate; with abundant 3-7% arkosic sands. Less than 1% white weathered material. 80% red sandstone and siltstone. Lithology change.
11850-11860	Sandstone clear and dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to coarse grain. As above with arkosic sands 3-7%. Abundant 5-10% white weathered material. 70% red sandstone and siltstone.
11860-11870	Sandstone conglomerate clear and dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to coarse grain. As above with approximately 2% green siltstone to sandstone. 60% red sandstone and siltstone.
11870-11880	As above. 60% red sandstone and siltstone.
11880-11890	As above. 50% red sandstone and siltstone.
11890-11900	Sandstone to sand clear and dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to coarse grain. As above with an increase in loose quartz and potash-feldspar. 40% red sandstone and siltstone.
11900-11910	As above. 40% red sandstone and siltstone.

11910-11920	As above with an increase in potash-feldspar. 40% red sandstone and siltstone.
11920-11930	As above. 40% red sandstone and siltstone.
11940-11950	Sandstone to arkosic sands clear and dark reddish brown (10 R 3/4) to very dusky red (10 R 2/2) fine to coarse grain. Abundant arkosic sands. 30% red sandstone and siltstone.
11950-11960	As above. 30% red sandstone and siltstone.
11960-11970	As above. 30% red sandstone and siltstone.
11970-11980	As above.
11980-11990	As above.
11990-12000	As above. Abundant potash-feldspar with 2-3% light green sandstone. 30% red sandstone and siltstone.
12000-12010	As above. 30% red sandstone and siltstone.
In granite:	The following samples were continuous, but were described every 50 feet due to homogeneity of unit on geophysical logs.
12050-12060	As above. Potash-feldspar to quartz to mica? Green mineral. 25% red sandstone and siltstone.
12100-12110	As above. 10% red sandstone and siltstone.
12150-12160	As above. 10% red sandstone and siltstone.
12200-12210	As above. 7% red sandstone and siltstone.
12250-12260	As above. 5% red sandstone and siltstone.
12300-12310	As above. 5% red sandstone and siltstone.

12350-12360	As above. 5% red sandstone and siltstone.
12400-12410	As above. 5% red sandstone and siltstone.
12480-12486	As above. 5% red sandstone and siltstone. Total depth in granite.


W
E
846
KB 60'
769
KB 76'
745
KB 76'
HAYNESVILLE
SMACKOVER
Sm 2
Sm 1
NORPHLET
LOUANN
EAGLE MILLS
BASEMENT
12939
-12879
11789
-11713
12515
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13331
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12101
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12820
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13487
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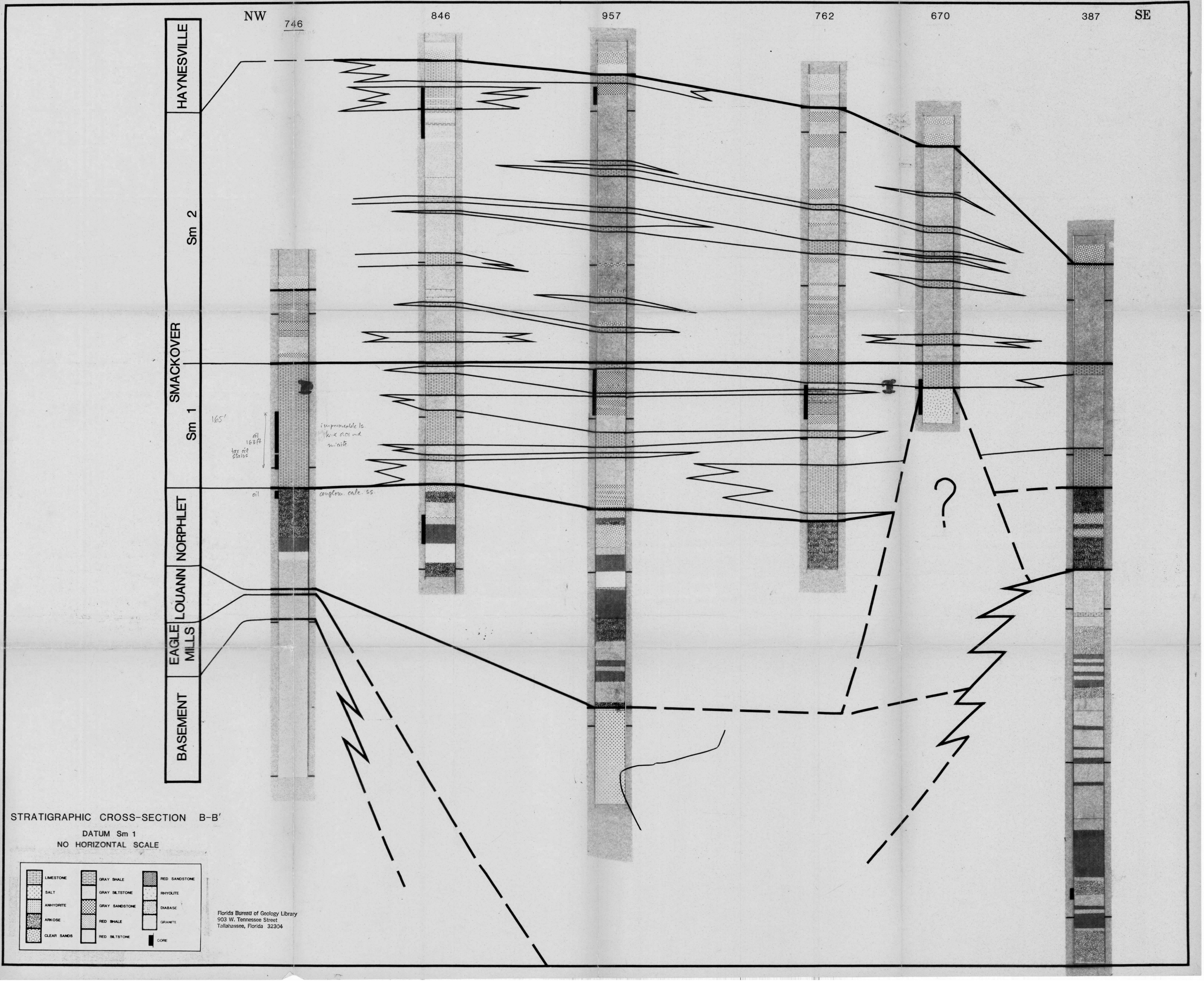
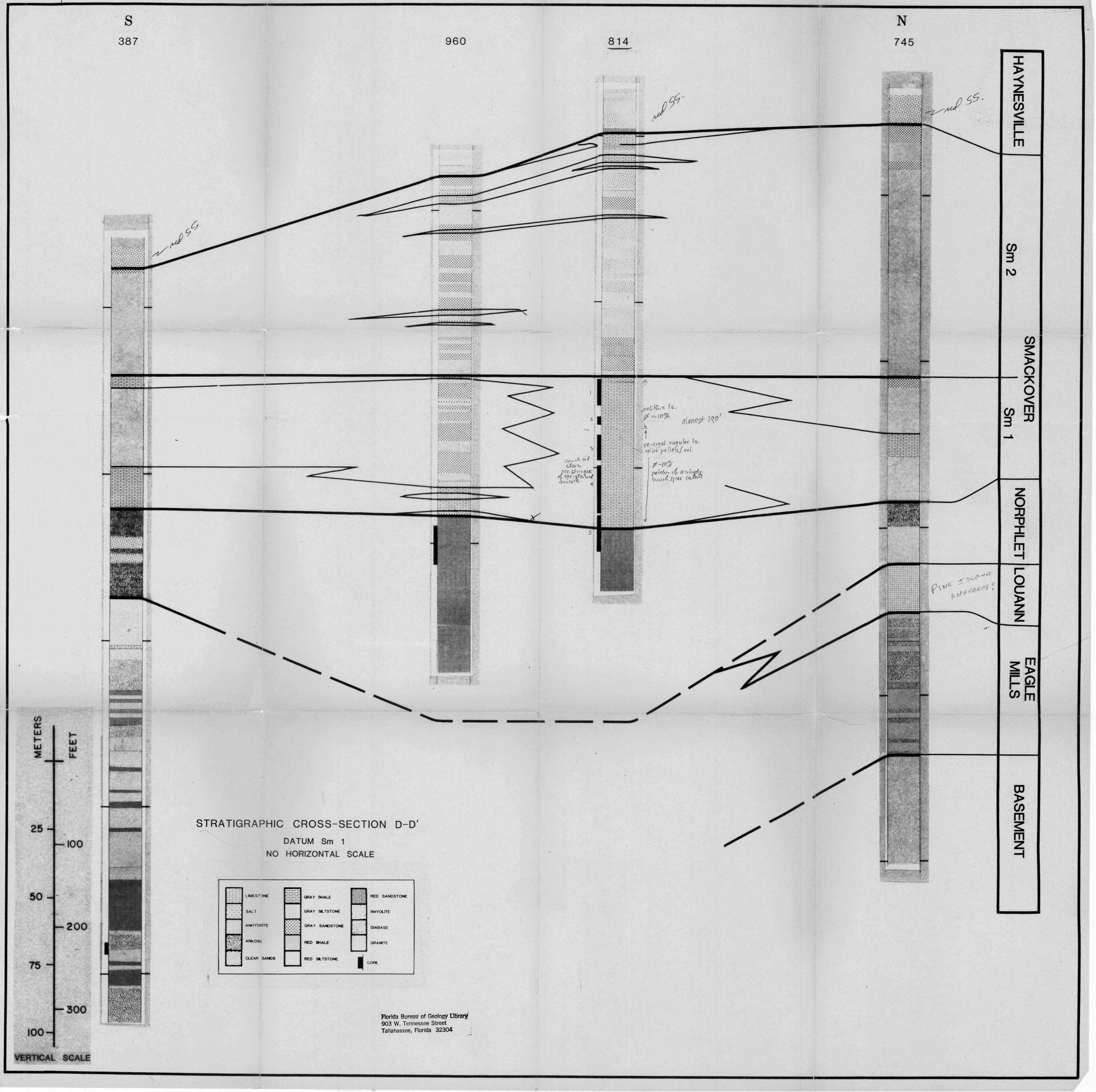
12324
-12248
11969
-11893
12044
-11968
12102
-12026
12530
-12454
-12197
STRATIGRAPHIC CROSS-SECTION A-A'
DATUM Sm 1
NO HORIZONTAL SCALE
LIMESTONE
SALT
ANHYDRITE
ARKOSE
CLEAR SANDS
GRAY SHALE
GRAY SILTSTONE
GRAY SANDSTONE
RED SHALE
RED SILTSTONE
RED SANDSTONE
RHYOLITE
DIABASE
GRANITE
CORE



STRATIGRAPHIC CROSS-SECTION B-B′

DATUM Sm 1

NO HORIZONTAL SCALE



STRATIGRAPHIC CROSS-SECTION D-D′

DATUM Sm 1

NO HORIZONTAL SCALE