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PRELIMINARY REPORT ON BURIED PRE-MESOZOIC ROCKS IN FLORIDA AND ADJACENT STATES

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INTRODUCTION

Since the year 1900 more than 500 oil and gas test wells have been drilled in the Coastal Plain of Florida, Alabama, and Georgia. The wells range in depth from a few hundred feet to more than 15,000 feet. The deepest tests in the southeastern Coastal Plain are Gulf Oil Corporation's State of Florida well No. 1 (sec. 2, T. 67 S., R. 29 E.), on Big Pine Key, Monroe County, Fla., which reached a total depth of 15,455 feet, and Humble Oil & Refining Company's J. R. Williams well No. 2 (sec. 21, T. 6 N., R. 4 W.), Washington County, Ala., abandoned at the total depth of 15,659 feet. Both of these wells were completed in rocks of probable Jurassic age.

By far the greater number of oil test wells in the southeastern States penetrated only Cenozoic and Mesozoic rocks, but information is available on 78 wildcat wells that were drilled through those rocks into older rocks of a wide variety of types. Granite, diorite, metamorphic rocks, rhyolite, pyroclastic rocks, and Paleozoic strata have been encountered in different wells scattered throughout the region. All these pre-Mesozoic rocks are grouped together under the inclusive term "basement" rocks by some of the geologists who are conducting subsurface studies in connection with oil exploration. Most of the wells penetrating the pre-Mesozoic rocks in the southeastern Coastal Plain were drilled within the past decade, many of them within the past five years, and from a number of the wells unusually complete sets of cores of the older rocks were obtained. Although the cores furnished a wealth of new subsurface data, new problems were also raised, the solution of which can be furnished only by more and deeper tests. The stratigraphy and structure of the ancient rocks in the southeastern region bid fair to continue to be a fruitful field for investigation, and samples from additional tests are likely to bring to light new data that will require revision of some of the tentative conclusions and interpretations here expressed.

Based largely on petrographic and petrologic study of cores and cuttings, this report is an initial attempt to integrate the data from the widely dispersed wells that reveal a diverse lithologic pattern in the pre-Mesozoic rocks of the southeastern Coastal Plain. The discovery of buried volcanic and crystalline rocks and Paleozoic strata in Florida and southern Georgia is a comparatively recent addition to geologic knowledge. These new data may revise earlier ideas about certain paleogeographic boundaries and permit increased precision in the delineation of ancient landmasses and basins of sedimentation. In connection with exploration for oil in the southeastern States, an understanding of the geology of the pre-Mesozoic rocks is important because they comprise the floor upon which the Mesozoic strata were deposited. In this region, the Mesozoic strata are considered to be the ones most likely to contain reservoirs and structural features favorable for accumulation. Geophysical prospecting and interpretation of geophysical data may benefit from a record of the variations in depth and composition of the different kinds of pre-Mesozoic rocks.

The report proposes a threefold classification for the buried pre-Mesozoic rocks in Florida, the Coastal Plain of Georgia, and southeastern Alabama. These rocks are classified as: dominantly marine sedimentary Paleozoic rocks, which on the basis of faunal evidence, range in age from late Cambrian or early Ordovician to Silurian (Howell and Richards, 1949); rhyolitic lavas and pyroclastic rocks that are tentatively classified as early Paleozoic or pre-Cambrian; and granite, diorite, and metamorphic rocks, which are probably in part pre-Cambrian and in part of Paleozoic age. Penetration has not been sufficient to show definitely the vertical sequence of the different rock types that are encountered in different wells. The report discusses tentative conclusions on the sequence of the types of rocks in the foregoing classification.

In the western and central parts of the Alabama Coastal Plain, the downward sequence of the buried pre-Mesozoic rocks is Paleozoic sedimentary rocks that range in age from Pennsylvanian to Ordovician and Cambrian, and metamorphic rocks that are possibly pre-Cambrian. Rhyolitic lavas and pyroclastic rocks similar to those encountered in wells in the central part of peninsular Florida and southeastern Georgia have not been discovered in Alabama.

In connection with the study of the pre-Mesozoic rocks of the southeastern region, this report also discusses the intrusions and flows of diabase and basalt encountered in 18 wells. Data from a part of the wells point to a period of igneous activity during the early Mesozoic; in other wells the time of emplacement of the diabase has been less definitely determined and may be in part early Mesozoic and in part Paleozoic.

Tables 1, 2 and 3 show data on 78 wells that penetrated pre-Mesozoic rocks in the Coastal Plain of Alabama, Florida, and Georgia; table 4 shows data on 18 wells that encountered Triassic(?) diabase and basalt; and table 5 presents data on 12 significant deep wells that did not reach the pre-Mesozoic rocks. The geographic locations of the wells are shown on figures 1 and 2; figure 1 also shows diagrammatically the writer's interpretation of the subsurface distribution of the different kinds of pre-Mesozoic rocks. The geographic distribution of the rock types penetrated in

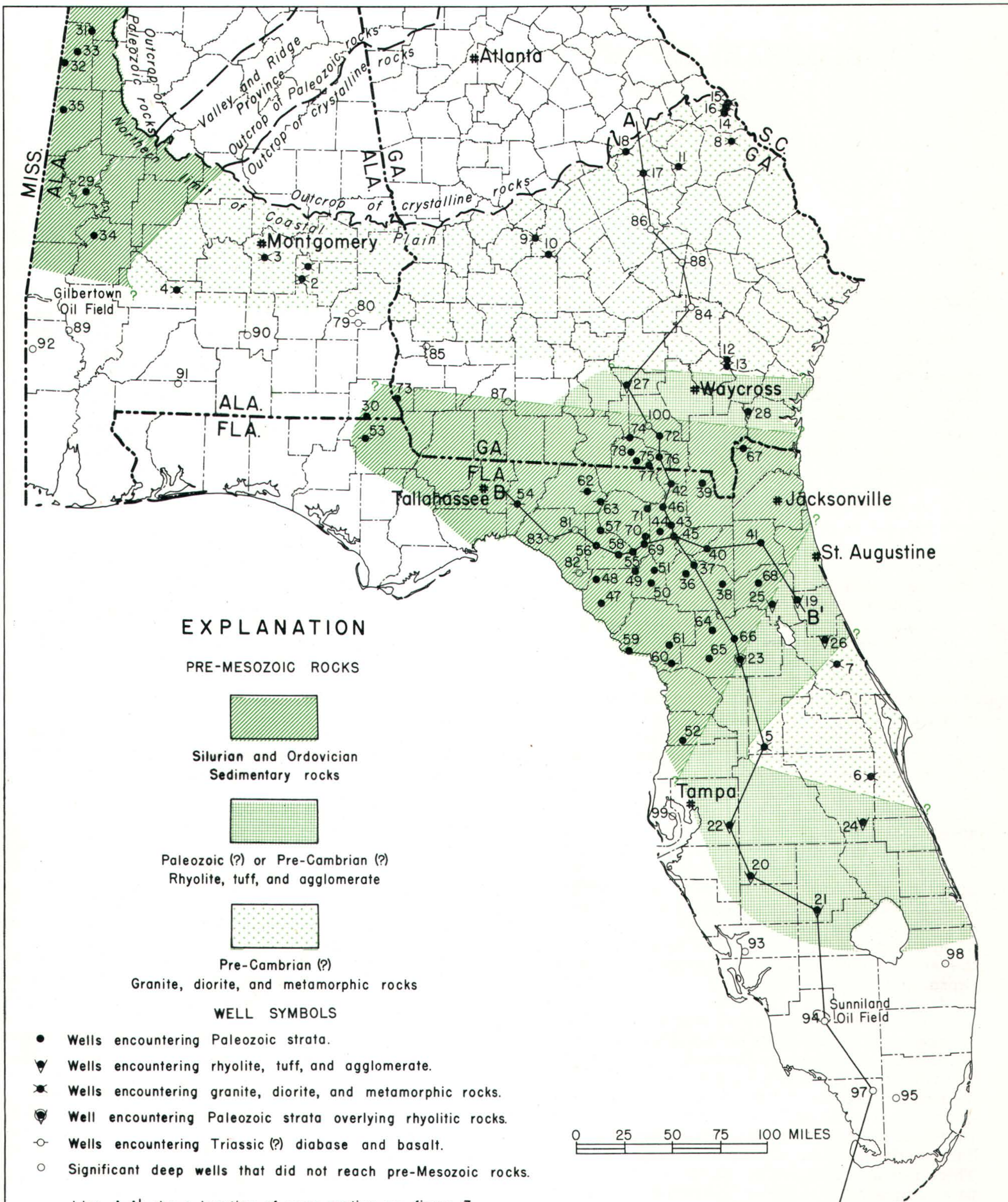

Figure 1.--Map of Florida and parts of Alabama and Georgia showing diagrammatically the subsurface distribution of the pre-Mesozoic rocks

the wells listed in tables 1-4 is summarized as follows:

	Ala.	Fla.	Ga.	Total
Pre-Mesozoic rocks:				
Granite, diorite, and metamorphic rocks	4	3	11	18
Rhyolitic lavas and pyroclastic rocks		8	2	10
Paleozoic sedimentary rocks	7	37	7	51
Total	11	47*	20	78*
Triassic(?) diabase and basalt	2	10	6	18

*Sun Oil Company's Camp well No. 1 (tables 2 and 3, and fig. 1), Marion County, Fla., penetrated volcanic agglomerate or tuff underlying Paleozoic sedimentary rocks.

The depth of penetration (tables 1, 2, and 3) into the pre-Mesozoic rocks varies widely, ranging from a few feet in many wells to 4,553 feet of Paleozoic strata in a well in Pickens County, Ala. Nearly half the wells shown in the tables penetrated the pre-Mesozoic rocks to depths of 100 feet or more. Most of these wells encountered Paleozoic sedimentary rocks; whereas only about a half-dozen wells penetrated the nonsedimentary rocks to depths of more than 100 feet.

Detailed petrographic analyses of the nonsedimentary rocks are not given in this report but it is anticipated that they will appear later in a separate publication by others. Other geologists of the Geological Survey are also now conducting detailed stratigraphic and structural studies of the Paleozoic sedimentary rocks of Florida and Georgia, basing their investigations on the lithologic character and faunal content of many well samples. The results of these investigations, which are still in progress, are expected to be published later.

Acknowledgments

Geologists employed by oil companies and by the Florida Geological Survey have been most generous and helpful in making available for study an exceptionally complete collection of core samples of the nonsedimentary rocks and Paleozoic strata from oil test wells in the southeastern States. Sincere thanks are expressed to the following geologists, who contributed samples used in the preparation of this report: I. J. Reed and Lois Shulz Herring, formerly with The California Co., Tallahassee, Fla.; J. E. Banks, Coastal Petroleum Co., Tallahassee; James A. Tierney and M. F. Kirby, Gulf Refining Co., Tallahassee; E. A. Murchison, T. J. Burnett, and W. C. Blackburn, Humble Oil & Refining Co., Tallahassee; H. A. Sellin, Magnolia Petroleum Co., Tallahassee; H. G. Walter, The Ohio Oil Co., Tallahassee; T. D. Rodgers, Stanolind Oil & Gas Co., Tallahassee; D. J. Munroe and Louise Jordan, Sun Oil Co., Tallahassee; L. C. Kirby, Tidewater-Associated Oil Co., Tallahassee; Herman Gunter, Director, Florida Geological Survey, Tallahassee; B. W. Blanpied and Roy T. Hazzard, Gulf Refining Co., Shreveport, La.; F. W. Rolshausen and E. D. Pressler, Humble Oil & Refining Co., Houston, Tex.; Earl Westmoreland, Seaboard Oil Co., Jackson, Miss.; D. Hoye Eargle and P. E. Lamoreaux, U. S. Geological Survey, University, Ala.

The writer is particularly indebted to Charles Milton, Geochemist, U. S. Geological Survey, Washington, D. C., for determinations and petrographic studies of samples of the nonsedimentary rocks of the southeastern region, and to Frank F. Grout, Visiting Professor of Geology, Florida State University, Tallahassee, for helpful suggestions and criticisms in connection with the preparation of this report.

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Thanks for reading and criticizing the manuscript are due Carle H. Dane, Watson H. Monroe, Josiah Bridge, and Jean M. Berdan, U. S. Geological Survey, Washington, D. C.

SUBSURFACE STRUCTURE OF THE FLORIDA PENINSULA

The map (fig. 2) and cross sections A-A' (fig. 3) and B-B' (fig. 4) illustrate clearly the large anticlinal fold or arch that is the dominant subsurface structural feature of eastern Florida and an adjacent part of southeastern Georgia. The anticlinal fold, or arch, which is approximately 275 miles long, trends south-southeastward and forms the axis of the Florida peninsula as far south as the latitude of Lake Okeechobee. In this report the name Peninsular arch is used to designate this dominant subsurface structural feature. The area of regional downwarping south of the Peninsular arch was designated the South Florida embayment by Pressler (1947, p. 1856) and the South Florida basin by Carsey (1950, fig. 3). By means of contours drawn at 1,000 foot intervals, figure 2 shows the configuration of the Peninsular arch at the surface of the pre-Mesozoic rocks. A profile of the arch is shown in cross section A-A' (fig. 3), which is drawn from north to south approximately parallel to the axis of the peninsula; cross section B-B' (fig. 4), in the northern part of the peninsula, is drawn from west to east along a line that is approximately at right angles to cross section A-A'.

Reference was made to a regional arch in eastern Florida in a U. S. Geological Survey press bulletin (Mossom, 1926, p. 220) issued about 1920. The arch was not named in the press bulletin, but

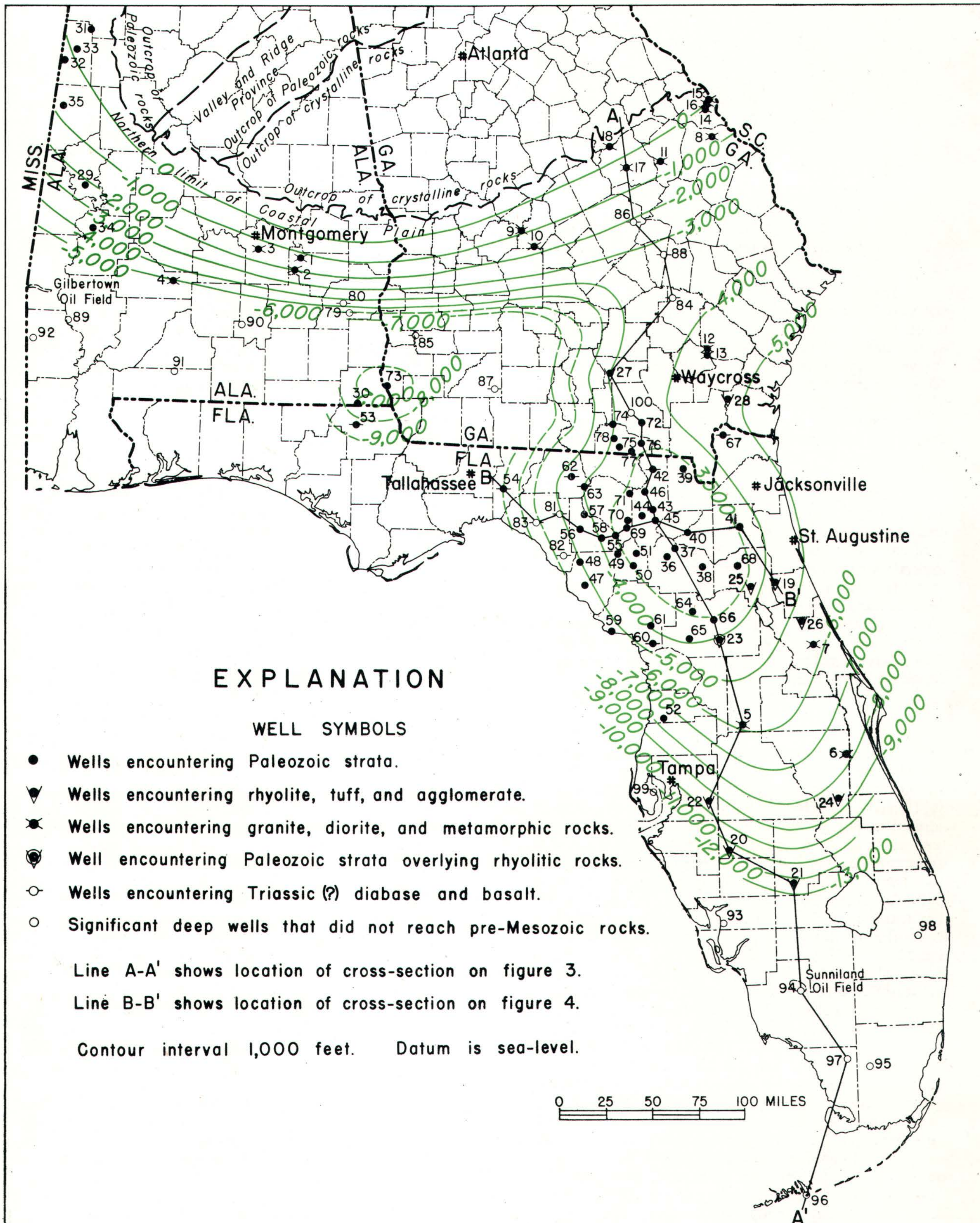


Figure 2.--Map of Florida and parts of Alabama and Georgia showing the configuration of of the surface of the pre-Mesozoic rocks

two locally high areas were named and described. The larger and higher area, in eastern Levy County, was called the Ocala uplift. Subsequent investigations have shown that the Ocala uplift centers around outcrops of Ocala limestone (upper Eocene) and Avon Park limestone (middle Eocene) in Citrus, Dixie, and Levy Counties on the west coast of the peninsula. The axis of the Ocala uplift does not coincide with the axis of the Peninsular arch, and surface and subsurface data show the absence of close structural relations between the two features. A report in preparation by geologists of the Florida Geological Survey (Vernon, 1950) will say that the Ocala uplift is a small flexure developed on the west flank of the Peninsular arch. The uplift is probably the result of post-Eocene disturbances in the surface and shallow subsurface formations.

The search for oil in Florida directed attention to the regional subsurface structure that occupies two-thirds of the peninsula. Possibly because this structure had no specific designation, geologists engaged in subsurface mapping in Florida extended the term Ocala uplift to apply to the regional arch. In order to clarify the structural terminology in Florida, the writer suggests that the name Ocala uplift should be restricted to the local surface feature.

PRE-MESOZOIC ROCKS

Granite, diorite, and metamorphic rocks

Fifteen wells in the Coastal Plain of Alabama and Georgia and three wells in the central part of peninsular Florida terminated in crystalline rocks that are classified as granite, diorite, and metamorphic rocks (table 1 and fig. 1).

Published reports supplied data (table 1) on 10 wells in Alabama and Georgia from which samples were not available; petrographic determinations of crystalline rocks encountered in five wells are shown in table 1 and in the following list:

The crystalline rocks encountered in wells in the Alabama and Georgia Coastal Plain represent the buried extension of the rocks of the southern Appalachian Piedmont, and like their outcropping counterparts the buried rocks are probably in part pre-Cambrian and in part of Paleozoic age. Nearly all the wells are a relatively short distance south of the Piedmont. The three most southerly ones are the McConnico well, Wilcox County, Ala., which is 60 miles southwest of the outcrop of the crystalline rocks, and the two Adams-McCaskill wells, Pierce County, Ga., 125 miles southeast of the Fall Line. By means of contours drawn at 1,000 foot intervals through the widely scattered wells just south of the Piedmont, figure 2 shows the approximate configuration of the surface of the buried crystalline rocks in Georgia and eastern Alabama. However, the contours would be less smooth and regular if more subsurface data were available. Published geological maps of Alabama and Georgia show that faults in the rocks of the Piedmont pass under the sedimentary rocks of the Coastal Plain. Temple Exploration Company's Smith Lumber Company well No. 1 (sec. 26, T. 8 N., R. 16 E.), Crenshaw County, Ala., was abandoned at the total depth of 10,830 feet before it reached the "basement" rocks. Hard red micaceous shale encountered in the bottom part of the hole is lithologically similar to Triassic rocks outcropping at many localities. The subsea elevation at the bottom of the Smith Lumber Company well when compared with the subsea elevation at the top of the crystalline rocks in Capital Oil & Gas Company's Gholston well, Bullock County, shows that in east-central Alabama the surface of the crystalline rocks slopes south, apparently at the rate of more than 250 feet per mile. In west-central Alabama, the rate of slope of the surface of the buried pre-Mesozoic rocks is approximately 70-80 feet per mile toward the southwest.

Lower Cretaceous clastic beds overlie gneiss in Capital Oil & Gas Company's Gholston well No. 1 (sec. 18, T. 14 N., R. 22 E.) and Pickett well No. 1 (sec. 22, T. 13 N., R. 21 E.), Bullock County, Ala. Lower Cretaceous or older Mesozoic rocks overlie

Well No.	Name of well	Kind of rock	Depth of penetration (Feet)	Total depth of well (Feet)
1	Capital O. & G. Co. Gholston No. 1 Bullock County, Ala.	Diorite gneiss	8	1,706
4	Seaboard Oil Co. McConnico No. 1 Wilcox County, Ala.	Granite gneiss	262	5,780
9	Tricon Minerals, Inc. Duke No. 1 Houston County, Ga.	Biotite gneiss	4	1,494
10	Tricon Minerals, Inc. Gilbert No. 1 Houston County, Ga.	Biotite gneiss	13	1,698
12	W. B. Hinton Adams-McCaskill No. 1 Pierce County, Ga.	Granite?	7	4,355

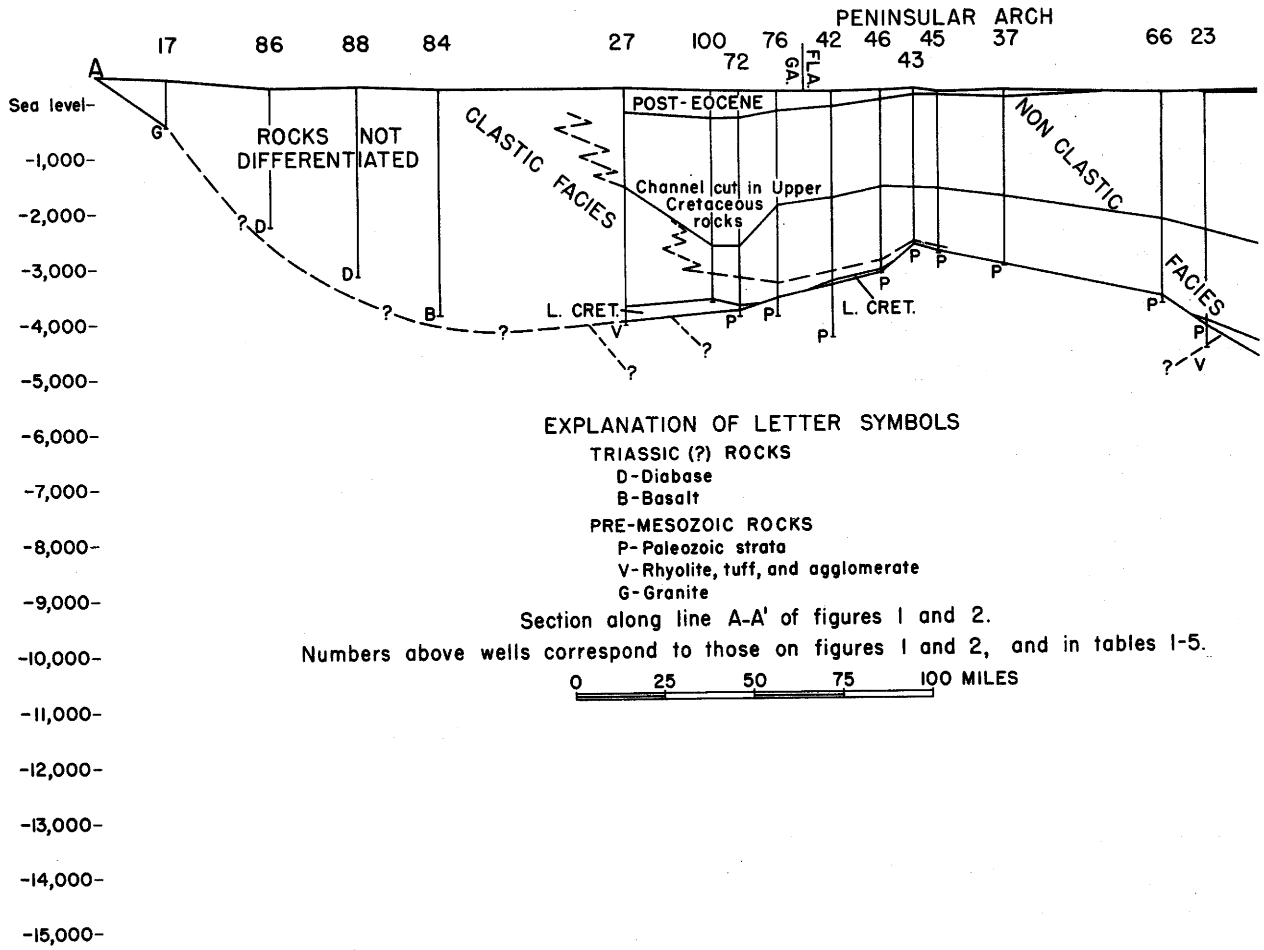
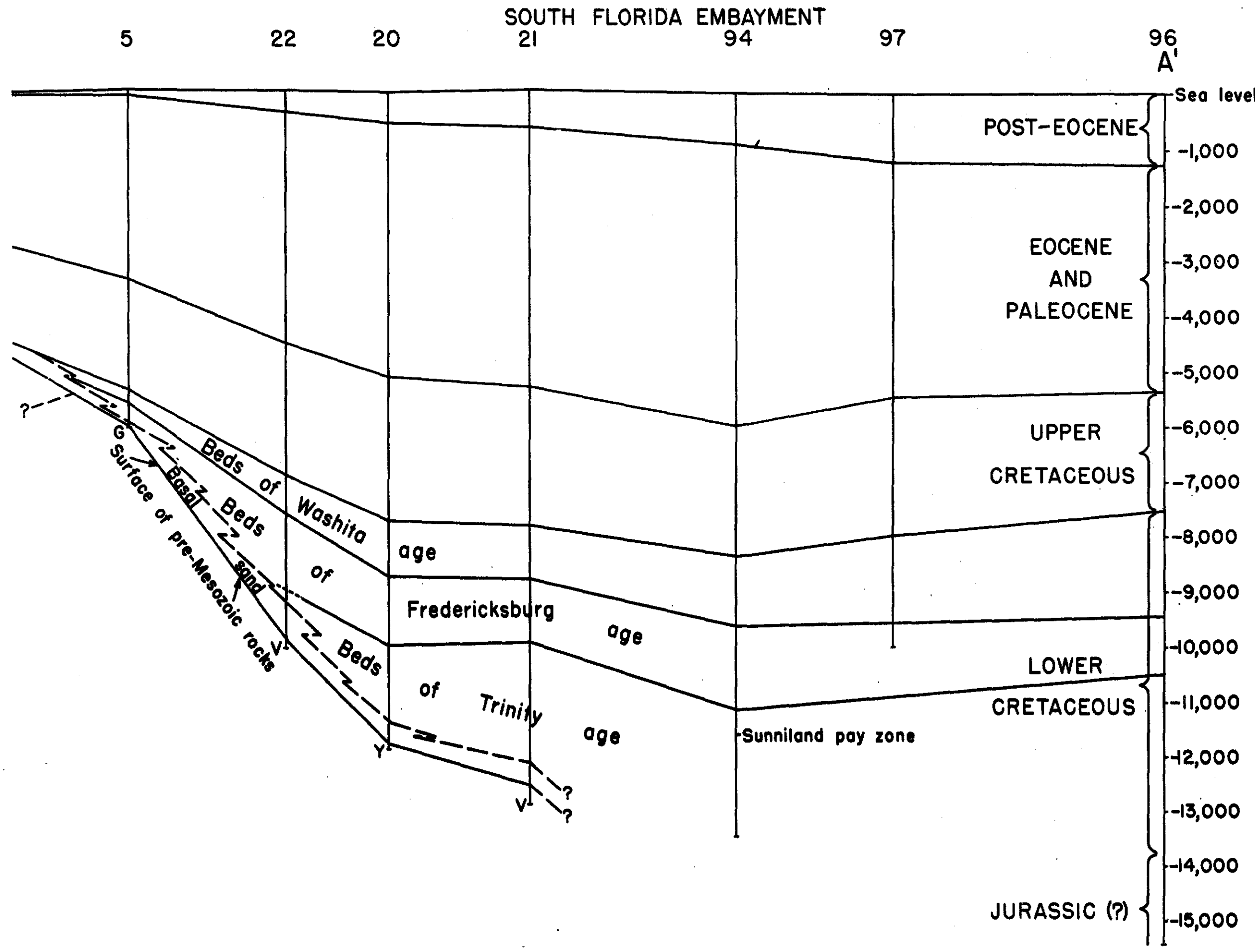


Figure 3.--North-south structural cross section from outcrop of crystalline rocks in central Georgia to Big Pine Key, Monroe County, Fla. Section along line A-A' (fig. 1)



SOUTH FLORIDA EMBAYMENT
5
22
20
21
94
97
96
A'
Sea level
-1,000
-2,000
-3,000
-4,000
-5,000
-6,000
-7,000
-8,000
-9,000
-10,000
-11,000
-12,000
-13,000
-14,000
-15,000
POST-EOCENE
EOCENE AND PALEOCENE
UPPER CRETACEOUS
LOWER CRETACEOUS
JURASSIC (?)
Beds of Washita age
Beds of Fredericksburg age
Beds of Trinity age
Basal sand
Surface of pre-Mesozoic rocks
Sunniland pay zone
G
V
Y
?

granite gneiss in Seaboard Oil Company's McConnico well No. 1 (sec. 32, T. 12 N., R. 10 E.) in Wilcox County, Ala. The middle member of the early Upper Cretaceous Atkinson formation (Applin and Applin, 1947, figs. 1 and 2, and text) overlies granite in W. B. Hinton's Adams-McCaskill well No. 1 (Lot 332, Land District 4) and Pan American Production Company's Adams-McCaskill well No. 1 (Lot 329, Land District 4), Pierce County, Ga. The beds overlying the crystalline rocks in the northern part of the Georgia Coastal Plain were not differentiated for purposes of this report.

Determinations of the crystalline rocks encountered in three wells in the central part of peninsular Florida are shown in table 1 and in the following list:

Well No.	Name of well	Kind of rock	Depth of penetration (Feet)	Total depth of well (Feet)
5	Oil Development Co. of of Fla. Arnold No. 1 Lake County, Fla.	Granite	17	6,120
6	Humble O. & R. Co. Carroll No. 1 Osceola County, Fla.	Granite	14	8,049
7	Sun Oil Co. Powell Land Co. No. 1 Volusia County, Fla.	Hornblende diorite	48	5,958

The writer's interpretation of the area occupied by the crystalline rocks in Florida is shown diagrammatically on the map (fig. 1). The age of the rocks has not been definitely determined, but alternative suggestions are presented that they are: a part of the pre-Cambrian basement complex; or Paleozoic in age.

Rhyolitic lavas and pyroclastic rocks.

Eight wells in the central part of peninsular Florida and two wells in southeastern Georgia terminated in volcanic rocks that for the most part are rhyolitic lavas, tuffs, and agglomerates (table 2 and fig. 1). Basalt occurred in two wells in association with rhyolite and tuff. Petrographic determinations of the volcanic rocks in the 10 wells are shown in table 2 and in the list shown on page 9.

The underground areal extent of sedimentary strata can be mapped with reasonable accuracy from data supplied by well samples. Igneous bodies, on the contrary, are discontinuous and when concealed their size and shape must be inferred from independent sources (Moody, 1949, p. 1414). In the diagrammatic representation (fig. 1) of the subsurface distribution of the rhyolitic lavas and pyroclastic rocks, the factors considered are as follows:

1. The geographic locations of the wells (fig. 1) roughly outline the areas within which the volcanic rocks occur.

2. The kinds of rocks encountered in the different wells are indicative of their extrusive origin. Samples of rhyolite show flow structure, and no positive evidence points to an intrusive origin for any of these rocks. The rocks occur possibly as a continuous body of tuffs and lava flows; or possibly they form a zone of more or less localized discontinuous bodies separated from each other by intervening sedimentary formations.

3. The uniform southward gradient (fig. 2) of the surface of the volcanic rocks in central peninsular Florida strongly suggests that they underlie the greater part of the area mapped diagrammatically in figure 1. Humble Oil & Refining Company's Carlton well No. 1 (sec. 34, T. 38 S., R. 29 E.), Highlands County, is the southernmost occurrence of the volcanic rocks. Other wells in the southern part of the State were not drilled sufficiently deep to reach the stratigraphic position of the volcanics.

The wells in Florida and Georgia did not penetrate the formations underlying the rhyolitic rocks. Lower Cretaceous clastic rocks unconformably overlie the volcanics in nine wells, and in one well, Sun Oil Company's Camp No. 1 (sec. 16, T. 16 S., R. 23 E.), Marion County, Fla., volcanic agglomerate is overlain by unfossiliferous sedimentary rocks that are lithologically correlated with Paleozoic strata.

Cross section A-A' (fig. 3) begins at the outcrop of the crystalline rocks in Georgia and extends southward through wells in the Coastal Plain of Georgia and peninsular Florida as far as Big Pine Key, Monroe County. Number 23 on cross section A-A' is a graphic log of the Camp No. 1 which shows the relation of the agglomerate to the Paleozoic strata. In the Camp well, the volcanic rocks encountered at the depth of 4615 feet are overlain by arkosic conglomerate which, in turn, is overlain by approximately 350 feet of quartzitic sandstone. The quartzitic sandstone in the Camp well is lithologically similar to sandstone encountered in other wells in Florida that contains fossils identified as Paleozoic species. A core of the conglomerate taken at the depth of 5474-5484 feet contains two kinds of material in the core, one of which is a fine-grained sediment that is possibly volcanic ash; the other, a coarse arkose composed of rounded pebbles of quartz and potassic feldspar.

A series of deep wells on the south flank of the Peninsular arch (cross section A-A', fig. 3) encountered a basal sand occurring unconformably above the volcanic and crystalline rocks and underlying nonclastic Lower Cretaceous Comanche beds. The layers of poorly sorted, fine to coarse sand, siltstone, and red and green

Well No.	Name of well	Kind of rock	Depth of penetration (Feet)	Total depth of well (Feet)
19	Humble O. & R. Co. Campbell No. 1 Flagler County, Fla.	Tuff and volcanic agglomerate of rhyolitic composition.	44	4,632
20	Humble O. & R. Co. Keen No. 1 Hardee County, Fla.	Lavas and pyroclastic rocks	106	11,934
21	Humble O. & R. Co. Carlton No. 1 Highlands County, Fla.	Basalt, rhyolite porphyry, and related kinds of volcanic rocks.	367	12,985
22	Humble O. & R. Co. Jameson No. 1 Hillsborough County, Fla.	Rhyolite and volcanic agglomerate	119	10,129
23	Sun Oil Company Camp No. 1 Marion County, Fla.	Volcanic agglomerate or tuff of rhyolitic composition	22	4,637
24	Humble O. & R. Co. Hayman No. 1 Osceola County, Fla.	Rhyolite	58	8,798
25	Sun Oil Co. Westbury No. 1 Putnam County, Fla.	Volcanic ash and tuff.	19	3,892
26	Grace Drilling Co. Retail Lumber Co., No. 1 Volusia County, Fla.	Rhyolitic? volcanic rock	21	5,424
27	Sun Oil Company Doster-Ladson No. 1 Atkinson County, Ga.	Volcanic tuff or agglomerate of rhyolitic composition.	76	4,296
28	The California Co. Buie No. 1 Camden County, Ga.	Volcanic ash and rhyolitic tuff.	281	4,955

shale comprising the basal sand merge laterally southward into the series of limestone, dolomite, and anhydrite that compose the Comanche rocks in the deeper part of the South Florida basin. Using microfaunal and lithologic studies of well samples, geologists have differentiated the Comanche limestones and dolomites of southern Florida into three stratigraphic units that are of Trinity, Fredericksburg, and Washita age, respectively. The cross section shows three wells drilled by Humble Oil & Refining Co. that encountered the basal sand below nonclastic beds of Trinity age. The wells are the Carlton well No. 1 (sec. 34, T. 38 S., R. 29 E.), Highlands County; Keen well No. 1 (sec. 23, T. 35 S., R. 23 E.), Hardee County; and Jameson well No. 1 (sec. 7, T. 31 S., R. 22 E.), Hillsborough County. In Oil Development Company of Florida's Arnold well No. 1 (sec. 17, T. 24 S., R. 25 E.), Lake County, the basal sand underlies limestone and dolomite of Fredericksburg age. One hundred and eighteen feet of argillaceous sandstone overlying Paleozoic strata in Sun Oil Company's Camp well No. 1, is classified as Washita or possibly Fredericksburg in age. The beds of Trinity age in the basinward wells pinch out against the southward sloping surface of the volcanic rocks. The up-dip wells show that, by series of overlaps, the progressively younger beds of Fredericksburg and Washita age transgress northward and, in turn, pinch out against the older rocks.

Humble Oil & Refining Company's Jameson well No. 1, Hillsborough County, Fla., at a depth of 10,010 feet, cored the contact of the Lower Cretaceous basal sand with the underlying volcanic rocks. The material in Core 122 at 9,995-10,003 feet and in Core 123 at 10,003-10,010 feet was studied petrographically and classified as an arkosic sediment. Core 124 at 10,010-10,019 feet was petrographically determined as rhyolite. Prof. Frank F. Grout, Visiting Professor of Geology at Florida State University, Tallahassee, studied a thin section of Core 124. His report states that flow structure in the rhyolite is shown by the arrangement of mineral grains in elongated parallel streaks that bend around phenocrysts. Prof. Grout also stated his opinion that the arkose in Core 122 and Core 123 could be derived from rhyolite.

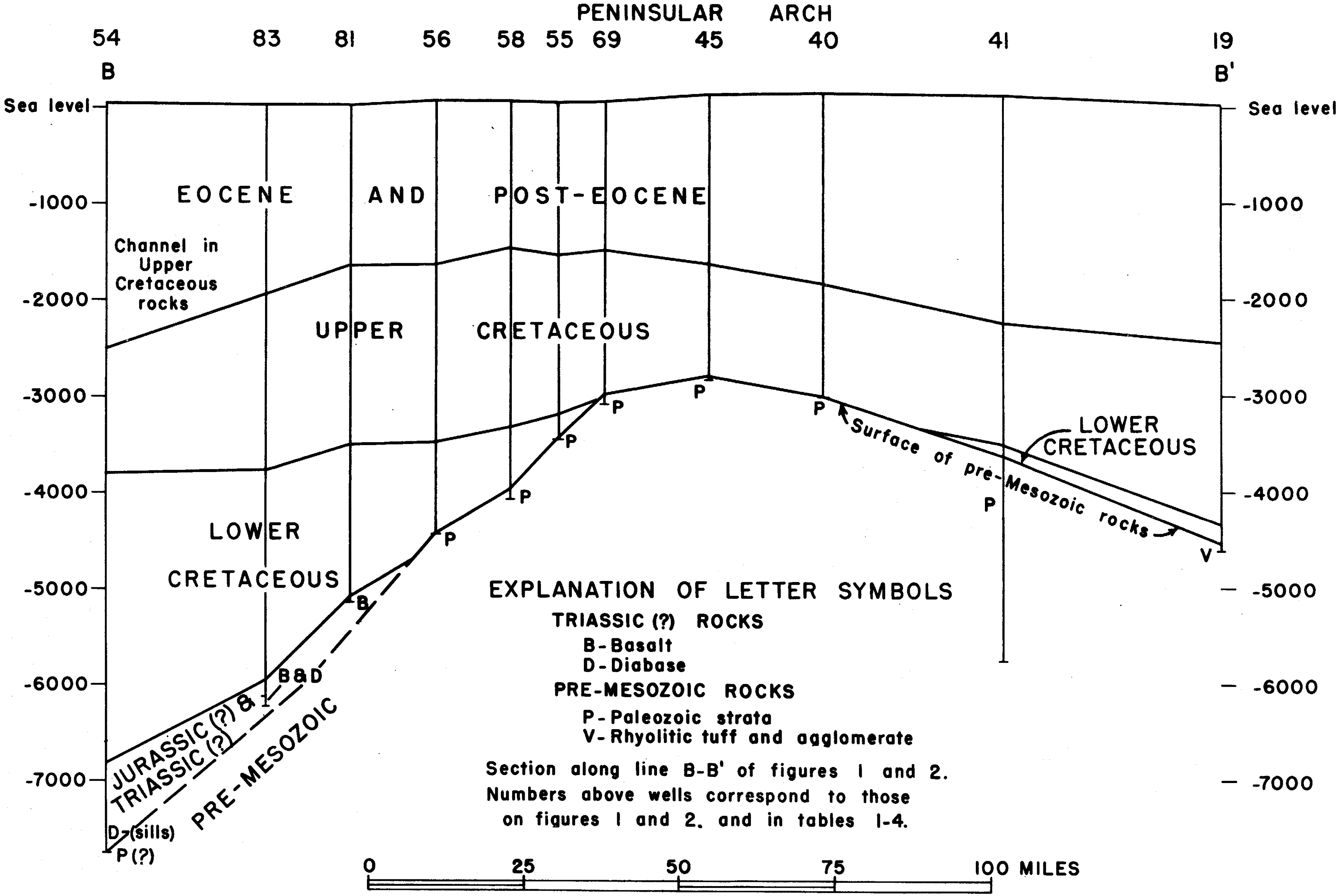


Figure 4.--West-east structural cross section from Jefferson County to Flagler County, Fla.
Section along line B-B' (fig. 1)

Several wells in Florida encountered thin layers of volcanic ash and bentonite interbedded in the Upper and Lower Cretaceous strata, but none of the wells penetrated tuffs, agglomerates, or lavas within the Cretaceous or younger formations. Conversely, in the Gulf Coastal Plain farther north, lavas, pyroclastic rocks, and tuffaceous sandstones are interbedded in early and middle Upper Cretaceous formations. Moody (1949, pp. 1427-1428) has pointed out that data from deep wells in the northern Gulf Coastal Plain "verify and recapitulate the ideas and conclusions drawn from field observations made by earlier workers in Coastal Plain igneous geology." He presents data to show that "magma invaded the northern Gulf Coastal Plain during successive time intervals in the Mesozoic era; the first invasion may have transpired as early as the Triassic period; the last was mid-Upper Cretaceous in age."

The geologic setting of Florida is unique among areas of comparable size in the Gulf Coast. In the northern part of the peninsula, comparatively shallow oil test wells penetrate formations ranging in age from Recent to Paleozoic and possibly pre-Cambrian. Conclusions about the age and correlation of the buried igneous and metamorphic rocks of Florida depend, in part, on a comparative study of the Gulf Coast deposits in adjacent areas and, in part, on an understanding of rocks exposed in the southern Appalachian Piedmont. Information on the rocks of the Piedmont is, for the most part, fragmentary and controversial. However, in connection with estimates of the age of the rhyolite and pyroclastic rocks encountered in wells in Florida, it can be pointed out that published geologic maps of the Piedmont region show outcrops of volcanic rocks, the age of which has been variously regarded as pre-Cambrian or Paleozoic. The Geologic Map of the United States (1933) classifies as pre-Cambrian ("Algonkian?") a belt of metabasalt and aporhyolite that extends across North Carolina into southern Virginia. The Tectonic Map of the United States (1944) shows the Virgilina syncline and a number of other areas in the southeastern Piedmont in which Paleozoic(?) volcanics occur. The Geologic Map of North America (1946) shows a belt of "Paleozoic volcanic slate" that extends northeastward from east-central Georgia into southern Virginia. On the State Geologic Map of Georgia (1939), the slates, quartzites, and volcanics of the Little River series in the east-central part of the State are classified as pre-Cambrian. King (1950, p. 657) discussed the significance of the somewhat metamorphosed sedimentary and volcanic rocks of the Carolina slate belt in the southeast part of the Piedmont province. He pointed out that various suggestions have been made placing the age of the "volcanic series" in a range from pre-Cambrian to Paleozoic.

King (1949) described the base of the Cambrian in the southern Appalachians and discussed the geology of areas in northeast Tennessee and southwest Virginia in which tuffaceous deposits and lava flows are interbedded with early Paleozoic sedimentary rocks. The Unicoi formation, classified by King (1949, p. 521) as the basal formation of the Lower Cambrian Chilhowee group "contains flows of amygdaloidal basalt and associated tuffaceous shales and sandstone. Great variations in the volcanics of the Unicoi may be observed both along the strike and between different outcrop belts. In places, two or more volcanic beds are present, each 100 feet or more thick; in others a single thin bed is present; in others volcanic rocks are lacking." In the vicinity of Mt. Rogers, immediately north of the Virginia-Tennessee line, a body of dominantly rhyolitic volcanic rocks is classified by King (1949, p. 519) as the top of the pre-Cambrian Ocoee series in northeastern Tennessee.

Data from additional deep wells are needed to establish definitely the stratigraphic position of the rhyolitic lavas and pyroclastic rocks encountered in wells in central Florida and southeastern Georgia. The full thickness of the extrusive rocks has not been penetrated, and well data do not reveal the nature of the underlying formations. As a working hypothesis in connection with the preparation of this report, the age of these volcanic rocks is tentatively classified as early Paleozoic or possibly pre-Cambrian; they are believed to be older than the Paleozoic strata of the Florida-Georgia area and are mapped as a unit, here interpreted as a continuous body of extrusive rocks or possibly a zone of closely related, localized beds. The factors that form the basis for this classification are summarized below:

1. Sun Oil Company's Camp well encountered volcanic agglomerate underlying deposits that are lithologically correlated with early Paleozoic strata in other wells in Florida; an arkosic conglomerate rests on the volcanic rocks and is possibly derived from them.

2. The pre-Cretaceous age of the rhyolitic rocks in central Florida is shown by the series of overlaps in the Lower Cretaceous rocks that pinch out against the volcanics on the south flank of the Peninsular arch. Tuffs, agglomerates, and lavas have not been found in the Cretaceous and younger formations in Florida.

3. Geologic maps and reports relating to the southeastern Piedmont region and the southern Appalachians show the widespread occurrence of early Paleozoic and pre-Cambrian volcanic rocks.

The volcanic rocks lack indications of the effects of dynamic metamorphism, and consequently may be younger than pre-Cambrian. In this connection it is pointed out that the Paleozoic strata in the Florida-Georgia area are horizontally bedded and unmetamorphosed. On the other hand, sills and flows of diabase and basalt which are discussed in subsequent pages of this report are classified, in part at least, as the products of an early Mesozoic (Triassic?) period of volcanism that is unrelated to the rhyolitic rocks. These cut Paleozoic and Triassic(?) sediments and are therefore younger. On the contrary, the rhyolites are not known to cut or overlie these rocks, and are therefore presumably older.

Paleozoic sedimentary rocks.

Paleozoic sedimentary rocks (fig. 1) have been encountered in two geographically separate areas in the southeastern Coastal Plain. One area extends westward from west-central Alabama into Mississippi; the other occupies the north part of the Florida peninsula and an adjacent part of southeastern Georgia. The Paleozoic strata of the Florida-Georgia sector probably extends westward to southwest Georgia, southeast Alabama, and the panhandle part of Florida where

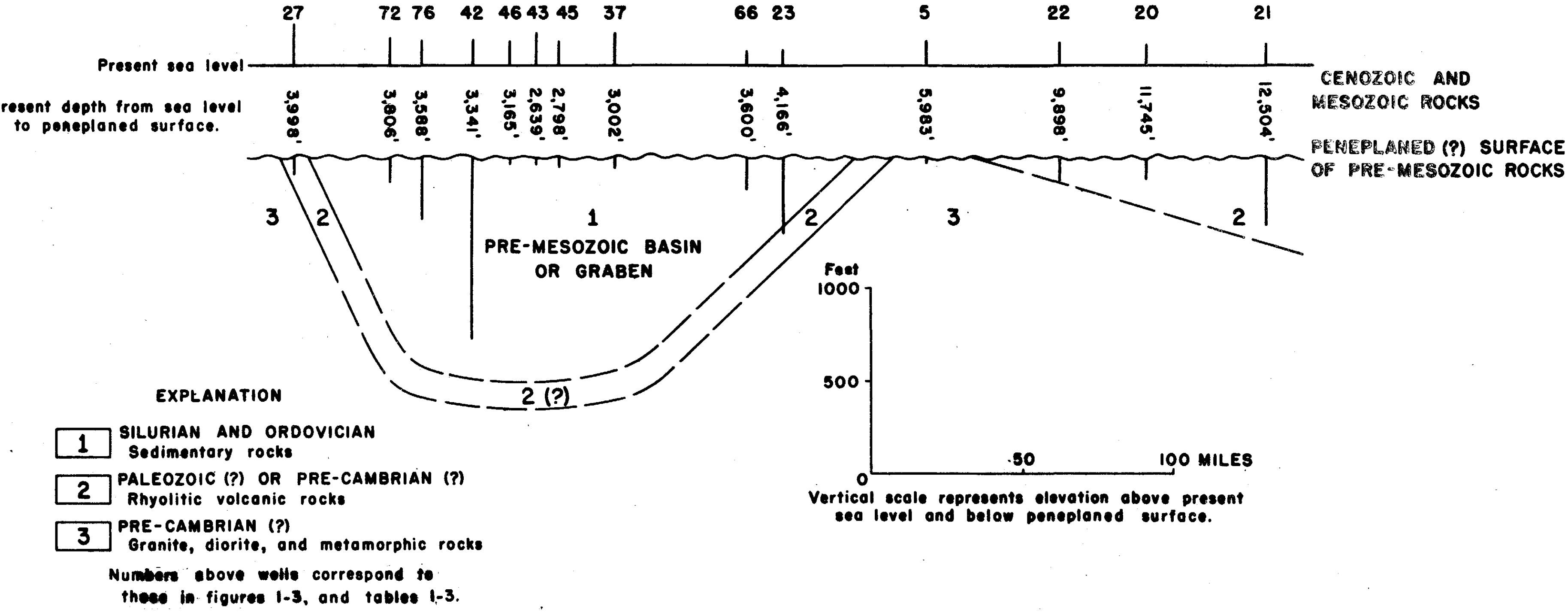


Figure 5

DIAGRAMMATIC CROSS-SECTION ALONG PART OF LINE A-A' (FIGURES 1 AND 2) FROM ATKINSON COUNTY, GEORGIA, TO HIGHLANDS COUNTY, FLORIDA, SHOWING A TENTATIVE INTERPRETATION OF THE STRUCTURE AT THE END OF THE PALEOZOIC.

Figure 5.--Diagrammatic cross section along part of line A-A' (fig. 1) from Atkinson County, Ga., to Highlands County, Fla., showing an interpretation of the structure at the end of the Paleozoic era

three wells encountered closely related Paleozoic rocks. On the one hand, the Paleozoic strata in Florida and Georgia are a clastic facies that ranges in age from late Cambrian or early Ordovician to Silurian. On the other hand, the buried Paleozoic rocks in west-central Alabama range in age from Cambrian and Ordovician to Pennsylvanian, the early and middle Paleozoic strata being chiefly nonclastic.

West-central Alabama area.--The Paleozoic rocks of the subsurface in western Alabama represent, in general, the underground extension of the formations exposed in the southern Appalachians. In the southeastern part of the Black Warrior basin (Mellen, 1947) four wells encountered clastic rocks of Pennsylvanian age unconformably underlying sandstones and shales of the basal Upper Cretaceous Tuscaloosa group. The four wells and the oldest formation penetrated in each are shown in table 3 and in the following list:

Well	Name of well	Penetration into Paleozoic strata (Feet)	Total depth of well (Feet)	Oldest formation penetrated
31	Briggs and Knapp Wefel No. 1 Lamar County, Ala.	1,645	1,780	Limestone of Mississippian age.
32	De Soto O. & G. Corp. Gardner No. 1 Lamar County, Ala.	4,358	4,886	Highly siliceous limestone of Devonian or Silurian age.
33	Stanolind O. & G. Co. Woods No. 1A Lamar County, Ala.	2,845	3,170	Limestone of Mississippian age.
35	C. H. Murphy, Jr. Oden-Eaton No. 1 Pickens County, Ala.	4,553	5,503	Clastic rocks of Pennsylvanian age.

The folded and faulted rocks of the Appalachian Valley and Ridge province form the eastern boundary of the Black Warrior basin and plunge under the Coastal Plain deposits in central Alabama. Two wells (table 3 and fig. 1) in the Coastal Plain, Johnston and Hawkins' Willis well No. 1 (sec. 11, T. 20 N., R. 1 E.), Greene County, and E. C. Johnston's Peteet well No. 1 (sec. 3, T. 16 N., R. 2 E.), Marengo County, are situated on the subsurface projection of the Valley and Ridge province. The middle and late Paleozoic rocks were not encountered in these wells, which entered a series of Ordovician limestones and dolomites directly below Lower Cretaceous or older Mesozoic rocks. This relationship is similar to that found on the outcrop in Bibb and Shelby Counties about 50 miles farther northeast.

Florida-Georgia area.--The Paleozoic sedimentary rocks (fig. 1) in Florida and Georgia occupy an area roughly estimated at 25,000 square miles on the highest part of the Peninsular arch. The southeastern limit of the area extends diagonally across the peninsula from a point between Jacksonville and St. Augustine on the east coast, to about the north end of Old Tampa Bay on the west coast; the northern limit is less definite but apparently extends across southern Georgia approximately parallel to the State line. Paleozoic strata (table 3 and fig. 1) were encountered in 37 wells in the north part of Florida; in 7 wells in the adjacent part of southern Georgia; and in a well in the southeast corner of Alabama. The rocks are chiefly quartzitic sandstones and dark shales, which for the most part are horizontally bedded and unmetamorphosed. A core from one of the wells showed a maximum inclination of 20°-25°; and some geologists interpret the recrystallization of quartz grains seen in a few cores as evidence of incipient metamorphism. Cores and cuttings from scattered wells have yielded specimens of ostracods, conodonts and a number of megascopic fossils including species of brachiopods, cephalopods, gastropods, pelecypods, graptolites, trilobites and eurypterids. Fragments of crinoid stems have been found in well samples and worm tubes occur in some sandstone cores.

The Paleozoic sedimentary rocks in Florida and Georgia can be classified roughly on the basis of lateral lithologic variations. Near the southeastern limit of the area, half a dozen tests penetrated unfossiliferous, hard, white to light-tan micaceous feldspathic quartzitic sandstone containing occasional thin layers or irregular lenses of highly micaceous gray to greenish-gray shale and brick-red sandy shale. Two wells penetrated more than 2,000 feet of the quartzitic sandstone. Ten wells that encountered black shale are located in a belt along the State line in southern Georgia and the northern part of Florida. The hard slaty black to gray micaceous carbonaceous fissile shale is irregularly interlensed with thin layers of siltstone and fine-grained sandstone. Nearly 1,000 feet of black shale was penetrated in one well. A possible third lithologic variety of the Paleozoic rocks is recognized in tests situated between the group of wells that encountered the quartzitic sandstone and the ten wells encountering black shale. This variety consists of alternating layers of hard gray and white micaceous quartzitic sandstone and black, gray, and greenish-gray shale. Classification is indefinite, as a rule, in wells where the Paleozoic strata were penetrated no more than a few feet.

A vertical sequence has not been established for the different kinds of Paleozoic sedimentary rocks; and the groups of wells mentioned in the preceding paragraph are loosely segregated. For example, a number of wells in the "black shale belt" encountered quartzitic sandstone rather than shale. On the other hand, coastal Petroleum Company's Ragland well No. 1 (sec. 16, T. 15 S., R. 13 E.), Levy County, Fla., on the west coast of the peninsula, penetrated 40 feet of black shale of Paleozoic age just above the bottom of the 5,850-foot test; whereas, all other deep wells in this general area encountered quartzitic sandstone, and one of them, Stanolind Oil & Gas Company and Sun Oil Company's Perpetual Forest well No. 1 (sec. 5, T. 11 S., R. 11 E.), Dixie County, Fla., penetrated 2,282 feet of quartzitic sandstone between the depth of 5,228 feet and the total depth of the test at 7,510.

The stratigraphic relations of the different kinds of Paleozoic sedimentary rocks in Florida and the significance of their lateral variations are problems confronting geologists engaged in subsurface mapping. Some geologists have suggested that the lithologic differences in the rocks are possibly explained by facies changes brought about by lateral variations in depositional conditions; others have pointed out that pre-Mesozoic faulting may have brought into juxtaposition stratigraphic units having different lithology. The ultimate solution of the problem of the stratigraphy and pre-Mesozoic structure of the Paleozoic sedimentary rocks in Florida and Georgia awaits the drilling of deeper tests, and depends in large degree on lithologic and faunal studies now in progress that should eventually result in the differentiation of these rocks into stratigraphic units that are traceable from well to well.

Little is known about the contact of the Paleozoic strata and the underlying rocks. Sun Oil Company's Camp No. 1, mentioned in foregoing paragraphs, encountered volcanic agglomerate below quartzitic sandstone of Paleozoic age. No other wells in the Florida-Georgia area were drilled sufficiently deep to penetrate the rocks below the Paleozoic strata.

A major unconformity marks the contact between the Paleozoic strata and the overlying Mesozoic deposits. In different parts of the Florida-Georgia area, beds that range in age from early Mesozoic to middle Late Cretaceous rest on the Paleozoic strata. Nonmarine deposits that are tentatively classified as Triassic or possibly Jurassic in age overlie Paleozoic sedimentary rocks in the northwest part of peninsular Florida. The early Mesozoic beds pinch out against the Paleozoic rocks on the west flank of the Peninsular arch and are overlapped by Lower Cretaceous clastic beds. Lower Cretaceous beds wedge out around an area of Paleozoic strata on the high part of the arch. The Lower Cretaceous wedge thickens rapidly on the west and south flanks of the arch but is relatively thin on the north and east. The early Upper Cretaceous Atkinson formation overlaps the Lower Cretaceous beds and pinches out, in turn, around a smaller "area" of Paleozoic strata. In two or three wells on the crest of the arch, beds of Austin (middle Late Cretaceous) age rest directly on the Paleozoic rocks.

Numerous cores from wells on the Peninsular arch present physical evidence of the unconformity between the early Paleozoic strata and Mesozoic rocks. In the Paleozoic strata, dark shale or alternating beds of dark shale and sandstone grade gradually upward into a red zone, in which fossils have been found that are identical with those in the dark beds below. The beds showing the gradational color change are considered by some geologists to be variants of the same stratigraphic unit, the red color being the result of weathering along the unconformity at the top of the early Paleozoic. A coarse conglomerate of quartzite pebbles occurs at the contact of the Paleozoic strata and the Lower Cretaceous. Well-rounded pebbles an inch or more in diameter have been recovered in cores, and drilling experience suggests the presence of larger pebbles or boulders.

Reports by other writers have referred to the Paleozoic sedimentary rocks encountered in wells in Florida and Georgia, and some of the reports have described species of Paleozoic fossils. The more important of these reports are here summarized. In regard to Ocala Oil Corporation's Clark-Ray-Johnson (York) well No. 1 (sec. 10, T. 16 S., R. 20 E.), Marion County, Fla., Herman Gunter, State Geologist of Florida, reported (Gunter, 1928) "somewhere between the depths of 3,970 and 4,245 feet, the well passed out of sedimentary formations and into metamorphic rocks. The cuttings within the interval mentioned consist of micaceous schist, slate and quartzite." Cooke and Mossom (1929, pp. 44-45) subsequently described an incomplete set of cuttings from the York well, classifying as "probably Paleozoic or older" the formations encountered between approximately 4,000 feet and the bottom of the test at 6,180 feet. Campbell (1939, p. 95) suggested a long-range correlation between the rocks in the bottom part of the York well and lithologically similar rocks exposed in Cuba which other geologists had assigned to the San Cayetano (Upper Jurassic) formation. Applin and Applin (1944, p. 1723, figs. 13 and 22) did not assign a definite age to the rocks encountered in the York well below 4,100 feet, or to lithologically similar rocks occurring below 3,520 feet in J. S. Cosden's Lawson well No. 1 (sec. 25, T. 13 S., R. 20 E.), also in Marion County. They classified the age of these deposits as "Lower Cretaceous or older." Cooke (1945, p. 21) designated as "probably of Paleozoic age" the rocks penetrated in the York well between 4,100 feet and 6,180 feet, the total depth. In the present report, the quartzitic sandstone in the York and Lawson wells is classified as early Paleozoic.

Between the depths of 4,640 and 4,808 feet, St. Mary's River Oil Corporation's Hilliard Turpentine Co. well No. 1 (sec. 19, T. 4 N., R. 24 E.), Nassau County, Fla., encountered hard black noncalcareous shale which is interlensed with fine-grained quartzitic sandstone. The black shale overlies 13 feet of diabase at the bottom of the hole. The age of the black shale has been variously estimated. Campbell (November, 1939) tentatively assigned "these rocks to the Mississippian because of their similarity to the Chattanooga shales," and in this he was supported by R. S. Bassler of the United States National Museum. Schuchert (1943) discussed the occurrence of the black shale in the Hilliard well and questioned the Mississippian age determination. He thought the shale "more likely to be of Late Paleozoic (Pennsylvanian) age." Cole (1944, p. 32) has stated that in his opinion the rocks in question are Triassic in age and equivalent to the Newark series.

Applin and Applin (1944, p. 1724) suggested that the lithologic character of the black shale resembles Pennsylvanian or older rocks. Proof of the early Paleozoic age of the black shale in the Hilliard well was recently found by Jean Berdan, U. S. Geological Survey, who discovered a fragment of a eurypterid in the cuttings similar to and possibly identical with the form recently described by Kjellesvig - Waering (1950) from Sun Oil Company's Tillis No. 1 well, Suwannee County, Fla.

Howell and Richards (1949) described a species of brachiopod Lingulepis floridanus found in a core of fine-grained micaceous sandstone taken at the depth of 3,668-3,671 feet in Sun Oil Company's Langston well No. 1 (sec. 8, T. 8 S., R. 14 E.) Dixie County, Fla. The authors assigned a late Cambrian or early Ordovician age to the species.

Horace G. Richards (1948, p. 70) mentioned the occurrence of fossiliferous black shale in Coastal Petroleum Company's Ragland well No. 1 (sec. 16, T. 15 S., R. 13 E.), Levy County, Fla., and quoted the opinion of G. Arthur Cooper, United States National Museum, that megascopic fossils discovered in the shale are probably of Devonian or Silurian age.

F. M. Swartz (1949, p. 320) described and named Chevroleperditia chevronalis, a new genus and species of ostracod discovered in a core of black shale from the depth of 6,965-6,985 feet (6,995-7,015 feet, corrected depth) in Mont Warren's Chandler well No. 1 (lot 406, Land District 26), Early County, Ga. Swartz stated that the species is suggestive of a late Ordovician or early Silurian age for the shale in which it was found.

Erik N. Kjellesvig-Waering (1950) described and named a new species of Silurian eurypterid, Pterygotus floridanus, taken from a core at 3,552-3,568 feet in Sun Oil Company's Tillis well No. 1 (sec. 28, T. 2 S., R. 15 E.), Suwannee County, Fla.

TRIASSIC(?) DIABASE AND BASALT

Diabase and basalt have been discovered in 18 wells (table 4 and figs. 1 and 2) in the Coastal Plain of Alabama, Florida, and Georgia. Petrographic studies of well samples show that diabase occurs in 13 wells and basalt in three other wells, whereas two others encountered both diabase and basalt. The volcanic rocks occur as sills or dikes in some wells and presumably as flows in others. Four wells encountered diabase sills or dikes in clastic rocks of Triassic(?) age; four other wells encountered diabase and basalt sills in Paleozoic strata. Seven wells terminated in diabase and basalt underlying Lower Cretaceous or older Mesozoic deposits. Three wells encountered diabase underlying Lower Cretaceous or older Mesozoic rocks and overlying Paleozoic strata. The tabulation that follows shows the distribution of the 18 wells on the basis of the different kinds of basaltic rocks encountered.

Well	Name of well	Manner of occurrence	Remarks
		Diabase	
79	W. B. Hinton et al Creel No. 1 Barbour County, Ala.	Sill or dikes	In clastic rocks of Triassic(?) age.
80	H. A. Stebinger Robertson No. 1 Barbour County, Ala.	Sills or dike	In clastic rocks of Triassic(?) age.
54	Coastal Petroleum Co. Larsh No. 1 Jefferson County, Fla.	Sills or dike	In clastic rocks of Triassic(?) age.
62	Hunt Oil Co. Gibson No. 2 Madison County, Fla.	Flow? or sill	Underlies Lower Cretaceous or older Mesozoic clastic rocks; overlies black shale of Paleozoic age.
63	Hunt Oil Co. Gibson No. 4 Madison County, Fla.	Flow? or sill	Underlies Lower Cretaceous or older Mesozoic clastic rocks; overlies sandstone and shale of Paleozoic age.
67	St. Mary's River Oil Corp. Hilliard Turpentine Co. No. 1 Nassau County, Fla.	Sill or dike	Underlies black shale of Paleozoic age.
81	Gulf Oil Corp. Brooks-Scanlon Block 33 well No. 1 Taylor County, Fla.	Well terminated in diabase gabbro	Underlies early Mesozoic clastic rocks

Continued on page 16

Continued:

Well	Name of well	Manner of occurrence	Remarks
		Diabase (Continued)	
82	Gulf Oil Corp. Brooks-Scanlon Block 42 well No. 1 Taylor County, Fla.	Flow? Well terminated in diabase	Underlies early Mesozoic clastic rocks.
85	Sowega Minerals Exploration Co. West No. 1 Calhoun County, Ga.	Well terminated in diabase	Underlies early Mesozoic clastic rocks.
74	Humble O. & R. Co. Bennett and Langsdale No. 1 Echols County, Ga.	Sill or dike	In Paleozoic strata.
86	Calaphor Manufacturing Co. McCain No. 1 Laurens County, Ga.	Well terminated in diabase	Underlies Lower Cretaceous or older Mesozoic rocks.
87	Stanolind O. & G. Co. Pullen No. 1 Mitchell County, Ga.	Sills or dike	In clastic rocks of Triassic(?) age.
88	J. E. Weatherford Wilkes No. 1 Montgomery County, Ga.	Well terminated in diabase	Underlies Lower Cretaceous or older Mesozoic rocks.
		Basalt	
53	Humble O. & R. Co. Tindel No. 1 Jackson County, Fla.	Sills or dike	In Paleozoic strata.
60	Humble O. & R. Co. Robinson No. 1 Levy County, Fla.	Flow?	See data on well in table 4.
84	Felsenthal and Weatherford Bradley No. 1 Appling County, Ga.	Flow? Well terminated in basalt	Underlies Lower Cretaceous or older Mesozoic rocks.
		Diabase and basalt	
42	Humble O. & R. Co. Cone No. 1 Columbia County, Fla.	Sills or dike	In Paleozoic strata.
83	Humble O. & R. Co. Hodges No. 1 Taylor County, Fla.	Well terminated in diabase gabbro	Underlies early Mesozoic clastic rocks. See data on well in table 4.

The time of emplacement of the diabase and basalt has not been definitely established. Indications of volcanism are lacking in the Cretaceous and younger formations of the southeastern region, but evidence points to the early Mesozoic age of the diabase in a part of the wells listed in the foregoing tabulation. Four wells encountered diabase sills or dikes in clastic beds that are tentatively classified as Triassic in age. Cores and cuttings show that the strata are chiefly hard red micaceous shale and poorly sorted fine- to coarse-grained sandstone which are lithologically similar to Triassic shales and sandstones exposed in the southeastern Piedmont Two wells in east-central Alabama encountered diabase sills in Triassic(?) strata composed of highly arkosic sandstones, beds of volcanic ash and conglomerates. The conglomerates contain debris that suggests rapid erosion from nearby outcrops of basement rocks. Petrographic studies show that the diabase in the wells in the southeastern region is mineralogically similar to Triassic diabase exposed at many localities along the Atlantic seaboard. The diabase dikes in the Piedmont province in Georgia have been tentatively classified as Triassic, and one of the dikes is overlapped unconformably by the Coastal Plain deposits (Moody, 1949, p. 1411).

Additional subsurface data are needed to determine the age of the diabase and basalt sills or dikes that intruded the Paleozoic strata. The mineral composition of the diabase in the Hilliard well, Nassau County, Fla., has been compared to Triassic diabase. Cole (1944, pp. 89-94) quotes J. Osborne Fuller in regard to the diabase in the Hilliard well as follows: "The diabase in the Florida sample agrees surprisingly well in mineral composition with the upper chilled zone of the Palisade diabase. The sample from the Florida well is tentatively classified as Triassic in age."

PRE-MESOZOIC STRUCTURE OF THE FLORIDA PENINSULA

During the past 10 years, a quantity of new information has been accumulated regarding the areal distribution, lithology, and fauna of the different kinds of rocks that underlie the Coastal Plain deposits in Florida and adjacent part of south Georgia. In a report on the tectonic framework of the southeastern States, King (1950, pp. 657-658) discussed the general relations between the exposed rocks in the Appalachian Highlands and the unmetamorphosed and little-folded Paleozoic rocks of Florida. Nevertheless, information is lacking on important details of the stratigraphy and pre-Mesozoic structure of these buried rocks. Data from the scattered wells have not established the stratigraphic sequence of the different kinds of pre-Mesozoic rocks, and their complex structure is subject to a variety of interpretations. As a working hypothesis that may serve as a basis for future investigations, the writer offers his interpretation of the pre-Mesozoic geology of the rocks that form the core of the Florida peninsula. In connection with the map (fig. 1) showing the areal distribution of the rocks, a diagrammatic cross section (fig. 5) drawn through some of the deep wells in south Georgia and peninsular Florida portrays graphically this tentative interpretation of the stratigraphy and structure of the early Paleozoic and pre-Cambrian(?) rocks.

Figure 5 shows a regionally high area in the pre-Cambrian(?) crystalline rocks of central Florida, bordering on the south a basin or graben situated in the northern part of the peninsula. A thickness of more than 2,000 feet of Ordovician and Silurian strata occupies the downwarp, the axis of which trends northeastward approximately at right angles to the axis of the peninsula. The subsurface data are not sufficient to classify the downwarped feature definitely, and alternative possibilities are pointed out. On the one hand, the lateral lithologic variations of the Paleozoic strata discussed in preceeding paragraphs suggest deposition of the sediments in a progressively subsiding basin. On the other hand, the thickness of more than 2,000 feet of quartzitic sandstone encountered in wells near the southeastern limit of the area suggest entrapment of a segment of the early Paleozoic strata in a graben or series of blocks that were downfaulted by post-Silurian tectonic movements. In either case, the sheltered position of the strata preserved them from destruction during the period of erosion that followed the Silurian deposition.

The Florida peninsula was apparently an area of nondeposition during post-Silurian Paleozoic time. Erosion and possibly peneplanation exposed on the land surface the pattern (fig. 1) of pre-Cambrian(?) and early Paleozoic rocks revealed by well cores. Subsequently, regional movements during the Mesozoic and Cenozoic were instrumental in shaping the present configuration of the Peninsular arch (figs. 2, 3, and 4) and the South Florida basin.

REFERENCES

Applin, P. L. and Applin, E. R., 1944, Regional subsurface stratigraphy and structure of Florida and southern Georgia: Am. Assoc. Petroleum Geologists Bull., vol. 28, no. 12, pp. 1673-1753.

Applin, P. L. and Applin, E. R., 1947, Regional subsurface stratigraphy, structure and correlation of middle and early Upper Cretaceous rocks in Alabama, Georgia, and north Florida: U. S. Geol. Survey Oil and Gas Inv. Prelim. Chart 26.

Campbell, R. B., Paleozoic under Florida?: Am. Assoc. Petroleum Geologists Bull., vol. 23, no. 11, pp. 1712-1713, November 1939.

__________ Outline of the geological history of peninsular Florida: Florida Acad. Sci. Proc., vol. 4, pp. 87-105.

Carsey, J. B., Geology of the Gulf coastal area and continental shelf: Am Assoc. Petroleum Geologists Bull., vol. 34, no. 3, pp. 361-385, March 1950.

Cole, W. S., Stratigraphic and paleontologic studies of wells in Florida - No. 3: Florida Geol. Survey Bull. 26, 1944.

Cooke, C. W., Geology of Florida: Florida Geol. Survey Bull. 29, 1945.

Cooke, C. W., and Mossom, Stuart, The geology of Florida: Florida Geol. Survey 20th Ann. Rept., 1927-1928, pp. 29-227, 1929.

Gunter, Herman, Basement rocks encountered in a well in Florida: Am. Assoc. Petroleum Geologists Bull., vol. 12, no. 11, pp. 1107-1108, November 1928.

Howell, B. F. and Richards, H. G., New Paleozoic linguloid brachipod from Florida: Wagner Free Inst. Sci. Bull., vol. 24, no. 4, pp. 35-37, November 1949.

King, P. B., The base of the Cambrian in the southern Appalachians (in two parts): Part I, Am. Jour. Sci., vol. 247, pp. 513-530, August 1949; Part II, Am. Jour. Sci. vol. 247, pp. 622-645, September 1949.

________ Tectonic framework of southeastern United States: Am. Assoc. Petroleum Geologists Bull., vol. 34, no. 4, pp. 635-671, April 1950.

Kjellesvig-Waering, E. N., A new Silurian eurypterid from Florida: Jour. Paleontology, vol. 24, no. 2, pp. 229-231, March 1950.

Mellen, F. F., Black Warrior basin, Alabama and Mississippi: Am. Assoc. Petroleum Geologists Bull., vol. 31, no. 10, pp. 1801-1816, October 1947.

Moody, C. L., Mesozoic igneous rocks of northern Gulf Coastal Plain: Am. Assoc. Petroleum Geologists Bull., vol. 33, no. 8, pp. 1410-1428, August 1949.

Mossom, Stuart, A review of the structure and stratigraphy of Florida: Florida Geol. Survey 17th Ann. Rept. 1924-1925, pp. 174-275, 1926.

Pressler, E. D., Geology and occurrence of oil in Florida: Am. Assoc. Petroleum Geologists Bull., vol. 31, no. 10, pp. 1851-1862, October 1947.

Richards, H. G., Studies on the subsurface geology and paleontology of the Atlantic Coastal Plain: Philadelphia Acad. Nat. Sci. Proc., vol. C, pp. 39-76, 1948.

Schuchert, Charles, Stratigraphy of the eastern and central United States, pp. 453-456, John Wiley and Sons, 1943.

Swartz, F. M., Muscle marks, hinge and overlap features, and classification of some Leperditiidae: Jour. Paleontology, vol. 23, no. 3, pp. 306-327, May 1949.

Vernon, R. O., Manuscript, in preparation, on the geology of Citrus and Levy Counties, Fla., (1950)

Table .. *Data on wells penetrating granite, diorite and metamorphic rocks in Alabama, Florida, and Georgia Coastal Plain.*

[The wells here listed are shown in figures 1 and 2 and some of them are shown on cross sections A - A' and B - B'. The numbers of the wells on the maps and cross sections correspond to those in this table. Elevations and depths expressed in feet, datum sea-level
*Rock determinations by Charles Milton, U. S. Geological Survey. **Rock determinations by Frank F. Grout, Visiting Professor of Geology, Florida State University, Tallahassee, Fla.]

Well No.	County	Name and location of well	Date of completion	Surface elevation	Type of crystalline rock	Depth to top of crystalline rock	Elevation at top of crystalline rock	Penetration of crystalline rock (feet)	Total depth of well	Remarks
					Alabama					
1	Bullock	Capital Oil & Gas Co. Mrs. Ethel B. Gholston No. 1 Sec. 18, T. 14 N., R. 22 E.	5-22-1945	300	*Diorite gneiss	1698	-1398	8	1706	
2	Bullock	Capital Oil & Gas Co. Fred Pickett No.1 Sec. 22, T. 13 N., R. 21 E.	6-13-1945	430	Metamorphic rock, probably gneiss	2495	-2065	28	2523	No cores taken in crystalline rock; determination from Geol. Survey of Alabama Bull. 57, p. 22, 1945.
3	Montgomery	Montgomery Oil Co. Snowdoun No. 1 Sec. 29 or 30, T. 15 N., R. 18 E.	1923	222	Crystalline rock?	1895	-1673	12	2007	Data from Geol. Survey of Alabama Bull. 50, pp. 158-159, 1941.
4	Wilcox	Seaboard Oil Co. S. M. McConnico No. 1 Sec. 32, T. 12 N., R. 10 E.	12-11-1945	186	*Granite gneiss	5518	-5332	262	5780	
					Florida					
5	Lake	Oil Development Co. of Florida J. Ray Arnold No. 1 Sec. 17, T. 24 S., R. 25 E.	1937	120	Granite	6103	-5983	17	6120	Not studied petrographically.
6	Osceola	Humble Oil & Refining Co. N. Ray Carroll No. 1 Sec. 10, T. 27 S., R. 34 E.	7-15-1946	62	**Altered and veined biotite granite	8035	-7973	14	8049	
7	Volusia	Sun Oil Co. Powell Land Company No. 1 Sec. 11, T. 17 S., R. 31 E.	9-14-1946	48	**Hornblende diorite	5910	-5862	48	5958	
					Georgia					
8	Burke	Three Creeks Oil Co. well 2.5 miles east of Green Cut.	1923		Crystalline rock	1002		31	1033	Data from Am. Assoc. Petroleum Geologists Bull. Vol. 29, no. 7, p. 926, July 1945.
9	Houston	Tricon Minerals, Inc. J. D. Duke No. 1 Lot 44, Land District 14	9- 7-1949	419	Biotite gneiss	1490	-1071	4	1494	
10	Houston	Tricon Minerals, Inc. H. B. Gilbert No. 1 Lot 266, Land District 13	9-25-1949	367	Biotite gneiss	1685	-1318	13	1698	
11	Jefferson	A. F. Lucas and Georgia Petroleum Oil Co. well 3.5 miles southwest of Louisville, Ga.	1907		In crystalline rock at total depth				1143	Data from Geol. Survey of Georgia Bull. 40, pp. 56-58, 1923.
12	Pierce	W. B. Hinton Adams-McCaskill No. 1 Lot 332, Land District 4	5- 7-1939	75	**Granite	4348	-4273	7	4355	
13	Pierce	Pan-American Production Co. Adams-McCaskill No. 1 Lot 329, Land District 4	5-13-1938	75	Granite	4345	-4270	31	4376	Not studied petrographically
14	Richmond	Water well at Georgia Training School, Gracewood, Ga.		136	Talcose schist	325	- 189	875	1200	Data from Am. Assoc. Petroleum Geologists Bull. vol. 29, no. 7, p. 925, July 1945
15	Richmond	Water well at Circular Court, 6.5 miles south of Augusta, Ga.		156	Talcose schist	175	- 19	154	329	Data from Am. Assoc. Petroleum Geologists Bull. vol. 29, no. 7, p. 925, July 1945

Table 1. *Data on wells penetrating granite, diorite and metamorphic rocks in Alabama, Florida, and Georgia Coastal Plain*--Continued.

Well No.	County	Name and location of well	Date of completion	Surface elevation	Type of crystalline Rock	Depth to top of crystalline rock	Elevation at top of crystalline rock	Penetration of crystalline rock (feet)	Total depth of well	Remarks
					Georgia--Continued.					
16	Richmond	Three Creeks Oil Co. well Allen's Station, 9 miles south of Augusta, Ga.	1921		In crystalline rock at total depth				400	Data from Am. Assoc. Petroleum Geologists Bull., vol. 29, no. 7, p. 926, July 1945
17	Washington	Layne-Atlantic's N. S. C. water well 2 miles southwest of Tennile, Ga.	1945	460	Granite	871	- 411	1	872	Data from oil company scouts
18	Washington	Middle Georgia Oil & Gas Co. well, 12 miles northwest of Sandersville, Ga.	1920		In crystalline rock at total depth				approx. 400	Data from Am. Assoc. Petroleum Geologists Bull., vol. 29, no. 7, p. 926, July 1945

Table 2. *Data on wells penetrating rhyolitic lavas, tuffs and agglomerates in central Florida and southeast Georgia.*

[The wells here listed are shown in figures 1 and 2 and some of them are shown on cross sections A - A' and B - B'. The numbers of the wells on the maps and cross sections correspond to those in this table. Elevations and depths expressed in feet, datum sea-level. Rock determinations by Charles Milton, U. S. Geological Survey.]

Well No.	County	Name and location of well	Date of completion	Surface elevation of well	Type of volcanic rock	Depth to top of volcanic rock	Sub-sea elevation at top of volcanic rock	Depth of penetration into volcanic rock	Total depth of well	Remarks
					Florida					
19	Flagler	Humble Oil & Refining Co. J. W. Campbell No. 1 Sec. 8, T. 11 S., R. 28 E.	2-26-1947	31	Tuff and volcanic agglomerate of rhyolitic composition.	4,588	- 4,557	44	4,632	"Mixed tuff derived from an igneous complex. Origin, sedimentary or explosive igneous action." F. F. Grout.
20	Hardee	Humble Oil & Refining Co. B. T. Keen No. 1 Sec. 23, T. 35 S., R. 23 E.	1-12-1948	83	Lava and pyroclastic rocks.	11,828	-11,745	106	11,934	
21	Highlands	Humble Oil & Refining Co. G. C. Carlton Estate No. 1 Sec. 34, T. 38 S., R. 29 E.	1-17-1946	114	Amygdaloidal basalt, rhyolite porphyry and related kinds of volcanic rocks.	12,618	-12,504	367	12,985	Southernmost occurrence of igneous rocks in Florida.
22	Hillsborough	Humble Oil & Refining Co. T. S. Jameson No. 1 Sec. 7, T. 31 S., R. 22 E.	7- 6-1946	112	Rhyolite and volcanic agglomerate	10,010	- 9,898	119	10,129	
23	Marion	Sun Oil Co. Henry N. Camp No. 1 Sec. 16, T. 16 S., R. 23 E.	5-20-1947	74	Volcanic agglomerate or tuff of rhyolitic composition	4,615	- 4,541	22	4,637	"Mixed tuff derived from an igneous complex" F. F. Grout.
24	Osceola	Humble Oil & Refining Co. W. P. Hayman No. 1 Sec. 12, T. 31 S., R. 33 E.	12-26-1946	86	Rhyolite	8,740	- 8,654	58	8,798	
25	Putnam	Sun Oil Co. H. E. Westbury et al No. 1 Sec. 37, T. 11 S., R. 26 E.	1-16-1949	32	Volcanic ash and tuff	3,873	- 3,841	19	3,892	
26	Volusia	Grace Drilling Co. Retail Lumber Co. No. 1 Sec. 2, T. 15 S., R. 30 E.	1-30-1949	44	Rhyolitic? volcanic rock.	5,403	- 5,359	21	5,424	No cores taken in volcanic rock
					Georgia					
27	Atkinson	Sun Oil Co. Doster - Ladson No. 1 Lot 71, Land District 7	1-31-1945	222	Volcanic tuff or agglomerate composed of hydrothermally altered rhyolite	4,220	- 3,998	76	4,296	
28	Camden	The California Co. John A. Buie No. 1 Lat. 31° 03' 01" North Long. 81° 52' 48" West	3-26-1948	65	Volcanic ash and rhyolitic tuff	4,674	- 4,609	281	4,955	

Table 3. *Data on wells penetrating Paleozoic sedimentary rocks in Alabama, Florida and Georgia Coastal Plain.*

[The wells here listed are shown in figures 1 and 2 and some of them are shown on cross sections A - A' and B - B'. The numbers of the wells on the maps and cross sections correspond to those in this table. Elevations and depths expressed in feet, datum sea-level.]

Well No.	County	Name and location of well	Date of completion	Surface elevation of well	Lithologic character of Paleozoic strata	Depth to top of Paleozoic strata	Sub-sea elevation at top of Paleozoic strata	Depth of penetration into Paleozoic strata	Total depth of well	Remarks
					Alabama					
29	**Greene**	**Johnston & Hawkins Co. Willis No. 1 Sec. 11, T. 20 N., R. 1 E.**	6-12-1940	130	Dolomite	2350	-2220	266	2616	Ordovician(?). 2350-2602.T.D. (electric log). Shreveport (La.) Geol. Society, 1945 Reference Rept., vol. I, plate 3.
30	**Houston**	**Union Producing Co. E. P. Kirkland No. 1 Sec. 20, T. 7 N., R. 11 W.**	7-15-1949	140	Quartzitic sandstone and black shale	7556	-7416	544	8100	
31	**Lamar**	**Briggs & Knapp Wefel No. 1 Sec. 25, T. 12 S., R. 14 W.**	3-24-1930	520	A lithologic description of the Paleozoic rocks is given in Geol. Survey of Alabama Bull. 50, pp. 56-58, 1941	135	+ 385	1645	1780	In limestone of Mississippian age at total depth.
32	**Lamar**	**De Soto Oil & Gas Corp. Gardner No. 1 Sec. 22, T. 15 S., R. 16 W.**	3-15-1936	324	The lithology of the Paleozoic units is shown by a graphic log on Mississippi Geol. Society's geologic cross section from south-central Tennessee to central Mississippi. (March 10, 1949)	528	- 204	4358	4886	Pennsylvanian 528-2275 Mississippian 2275-3992 Devonian-Silurian 3992-4886 T.D. Data from F. F. Mellen, Jackson, Miss. letter dated Mar. 20, 1950.
33	**Lamar**	**Stanolind Oil & Gas Co. Jack Woods No. 1A Sec. 23, T. 14 S., R. 15 W.**	8-27-1944	417		325	+ 92	2845	3170	Pennsylvanian 325-1710 Mississippian 1710-3170 T.D. Data from F. F. Mellen, Jackson, Miss. letter dated Mar. 20, 1950.
34	**Marengo**	**E. C. Johnston H. D. Peteet No. 1 Sec. 3, T. 16 N., R. 2 E.**	5-25-1944	247	Hard gray limestone Geol. Survey of Alabama Bull. 57, pp. 114-116, 1945	3875	-3628	648	4523	High Black River or Trenton age (Ordovician). 3875-4523 T.D. U. S. Geol. Survey Oil and Gas Inv. Preliminary Chart 26, fig. 10 and text, 1946.
35	**Pickens**	**C. H. Murphy, Jr. Oden - Eaton No. 1 Sec. 34, T. 19 S., R. 16 W.**	9-11-1946	315	Chiefly clastic deposits	950	- 635	4553	5503	Pennsylvanian. 950-5503 T. D. F. F. Mellen, "Black Warrior Basin, Alabama and Mississippi", Am. Assoc. Petroleum Geologists Bull. vol. 31, no. 10, fig. 8, October 1947.
					Florida					
36	**Alachua**	**Tidewater-Associated Oil Co. R. H. Cato No. 1 Sec. 23, T. 8 S., R. 18 E.**	2-14-1947	112	Quartzitic sandstone and shale.	3135	-3023	15	3150	
37	**Alachua**	**Tidewater-Associated Oil Co. Josie Parker No. 1 Sec. 33, T. 7 S., R. 19 E.**	5-11-1947	168	Quartzitic sandstone and shale.	3170	-3002	50	3220	
38	**Alachua**	**Tidewater-Associated Oil Co. J. A. Phifer No. 1 Sec. 24, T. 9 S., R. 21 E.**	4- 2-1947	132	Quartzitic sandstone and shale.	3217	-3085	11	3228	
39	**Baker**	**Hunt Oil Co. H. L. Hunt No. 1 Sec. 21, T. 1 N., R. 20 E.**	6- 1-1947	130	Quartzitic sandstone	3342	-3212	7	3349	

Table 3. *Data on wells penetrating Paleozoic sedimentary rocks in Alabama, Florida and Georgia Coastal Plain--Continued.*

Well No.	County	Name and location of well	Date of completion	Surface elevation of well	Lithologic character of Paleozoic strata	Depth to top of Paleozoic strata	Sub-sea elevation at top of Paleozoic strata	Depth of penetration into Paleozoic strata	Total depth of well	Remarks
					Florida--Continued.					
40	Bradford	Tidewater-Associated Oil Co. M. F. Wiggins No. 1 Sec. 15, T. 6 S., R. 20 E.	1- 5-1947	141	Quartzitic sandstone and shale	3140	-2999	27	3167	
41	Clay	Humble Oil & Refining Co. Foremost Properties Corp'n. No. 1 Sec. 4, T. 6 S., R. 25 E.	8-12-1947	115	Quartzitic sandstone	3725	-3610	2137	5862	
42	Columbia	Humble Oil & Refining Co. J. P. Cone No. 1 Sec. 22, T. 1 N., R. 17 E.	7-14-1948	141	Weathered zone? 3482-3492 Black shale 3492-4444	3482	-3341	962	4444	Six diabase sills in Paleozoic strata; see table 4.
43	Columbia	Sun Oil Co. Ruth M. Bishop No. 1 Sec. 10, T. 4 S., R. 17 E.	8-24-1949	174	Quartzitic sandstone and shale.	2813	-2639	15	2828	
44	Columbia	Sun Oil Co. W. F. Johnson No. 1 Sec. 27 - T. 4 S., R. 16 E.	5-31-1949	87	Quartzitic sandstone	3033	-2946	18	3051	
45	Columbia	Sun Oil Co. Clarence Loyd No. 1 Sec. 11, T. 5 S., R. 17 E.	7- 4-1949	124	Quartzitic sandstone and shale	2922	-2798	7	2929	
46	Columbia	Sun Oil Co. M. W. Sapp No. 1A Sec. 24, T. 2 S., R. 16 E.	11-16-1948	138	Black shale	3303	-3165	8	3311	
47	Dixie	Stanolind Oil & Gas Co. and Sun Oil Co. Perpetual Forest, Inc. No. 1 Sec. 5, T. 11 S., R. 11 E.	8- 8-1946	33	Quartzitic sandstone	5228	-5195	2282	7510	
48	Dixie	Sun Oil Co. P. C. Crapps "A", well No. 1 Sec. 36, T. 8 S., R. 10 E.	3- 6-1949	41	Sandstone and shale	5016	-4975	88	5104	
49	Dixie	Sun Oil Co. Hazel Langston No. 1 Sec. 8, T. 8 S., R. 14 E.	11-10-1946	33	Quartzitic sandstone and shale	3645	-3612	26	3671	
50	Gilchrist	Sun Oil Co. Alto Adams No. 1 Sec. 15, T. 9 S., R. 15 E.	3-27-1946	93	Quartzitic sandstone and shale	3588	-3495	165	3753	
51	Gilchrist	Sun Oil Co. Williams Bros. No. 1 Sec. 12, T. 8 S., R. 15 E.	9-30-1948	77	Quartzitic sandstone and shale	3348	-3271	18	3366	
52	Hernando	Ohio Oil Co. Hernasco Corp. No. 1 Sec. 19, T. 23 S., R. 18 E.	6-23-1946	47	Quartzitic sandstone	7720	-7673	752	8472	
53	Jackson	Humble Oil & Refining Co. C. W. Tindel No. 1 Sec. 8, T. 5 N., R. 11 W.	3-14-1949	128	Red and gray sandstone and shale	8440	-8312	805	9245	Two basalt sills in Paleozoic strata; see table 4.
54	Jefferson	Coastal Petroleum Co. E. P. Larsh No. 1 Sec. 1, T. 2 S., R. 3 E.	1-10-1949	51	Quartzitic sandstone	7909	-7858?	4?	7913	Paleozoic age of quartzitic sandstone not definitely determined.
55	Lafayette	Coastal Petroleum Co. Ronald Sapp No. 1 Sec. 18, T. 6 S., R. 14 E.	3-19-1949	45	Quartzitic sandstone and shale	3480	-3435	27	3507	
56	Lafayette	Gulf Oil Corp. Brooks-Scanlon, Inc. Block 49, well No. 1 Sec. 36, T. 5 S., R. 10 E.	10- 5-1949	87	Quartzitic sandstone	4505	-4418	7	4512	

Table 3. Data on wells penetrating Paleozoic sedimentary rocks in Alabama, Florida and Georgia Coastal Plain--Continued.

Well No.	County	Name and location of well	Date of completion	Surface elevation of well	Lithologic character of Paleozoic strata	Depth to top of Paleozoic Strata	Sub-sea elevation at top of Paleozoic strata	Depth of penetration into Paleozoic strata	Total depth of well	Remarks
					Florida--Continued.					
57	Lafayette	Humble Oil & Refining Co. R. L. Henderson No. 1 Sec. 20, T. 4 S., R. 11 E.	2-19-1948	52	Quartzitic sandstone and shale	4205	-4153	30	4235	
58	Lafayette	Sun Oil Co. P. C. Crapps No. 1 Sec. 25, T. 6 S., R. 12 E.	1-26-1946	70	Quartzitic sandstone and shale	4030	-3960	103	4133	
59	Levy	Coastal Petroleum Co. J. B. and J. T. Ragland No. 1 Sec. 16, T. 15 S., R. 13 E.	10-18-1947	14	Black shale	5810	-5796	40	5850	
60	Levy	Humble Oil & Refining Co. C. E. Robinson No. 1 Sec. 19, T. 16 S., R. 17 E.	8-20-1949	58	Six inches of altered black shale overlying quartzitic sandstone.	4377	-4319	232	4609	Basalt overlies Paleozoic strata; see table 4.
61	Levy	Sun Oil Co. J. T. Goethe No. 1 Sec. 31, T. 14 S., R. 17 E.	6- 8-1946	34	Quartzitic sandstone	3960	-3926	37	3997	
62	Madison	Hunt Oil Co. J. W. Gibson No. 2 Sec. 6, T. 1 S., R. 10 E.	5-31-1944	107	Black shale	4628	-4521	757	5385	
63	Madison	Hunt Oil Co. J. W. Gibson No. 4 Sec. 5, T. 2 S., R. 11 E.	5-18-1945	73	Quartzitic sandstone and shale	4060	-3987	36	4096	
64	Marion	J. S. Cosden W. L. Lawson No. 1 Sec. 25, T. 13 S., R. 20 E.	3-13-1928	195	Quartzitic sandstone	3660?	-3465	674?	4334	
65	Marion	Ocala Oil Corp. Clark-Ray-Johnson No. 1 Sec. 10, T. 16 S., R. 20 E.	July - 1928	80	Quartzitic sandstone	4100?	-4020?	2080?	6180	
23	Marion	Sun Oil Co. Henry N. Camp No. 1 Sec. 16, T. 16 S., R. 23 E.	5-20-1947	74	Quartzitic sandstone	4240	-4166	375	4637	4615-4637 T. D. Volcanic agglomerate; see table 2.
66	Marion	Sun Oil Co. H. T. Parker No. 1 Sec. 24, T. 14 S., R. 22 E.	4-23-1949	79	Quartzitic sandstone	3679	-3600	166	3845	
67	Nassau	St. Mary's River Oil Corp. Hilliard Turpentine Co. No. 1 Sec. 19, T. 4 N., R. 24 E.	1940	110	Black shale	4640	-4530	168	4824	4808-4824 T. D. diabase; see table 4.
68	Putnam	Sun Oil Company and Seaboard Oil Co. Q. I. Roberts No. 1A Sec. 19, T. 9 S., R. 25 E.	7-23-1947	206	Quartzitic sandstone	3320	-3114	8	3328	
69	Suwannee	Sun Oil Co. Earl Odom No. 1 Sec. 31, T. 5 S., R. 15 E.	1- 4-1947	73	Black shale	3040	-2967	121	3161	
70	Suwannee	Sun Oil Co. A. B. Russell Sec. 8, T. 5 S., R. 15 E.	7-31-1949	96	Quartzitic sandstone	3136	-3040	3	3139	
71	Suwannee	Sun Oil Co. J. H. Tillis No. 1 Sec. 28, T. 2 S., R. 15 E.	9- 1-1947	162	Black shale	3500	-3338	72	3572	
					Georgia					
72	Clinch	Hunt Oil Co. Alice Musgrove No. 1 Lot 198, Land District 12	1-18-1944	147	Black shale	3953	-3806	135	4088	

Table 3. *Data on wells penetrating Paleozoic sedimentary rocks in Alabama, Florida and Georgia Coastal Plain--Continued.*

Well No.	County	Name and location of well	Date of completion	Surface elevation of well	Lithologic character of Paleozoic strata	Depth to top of Paleozoic Strata	Sub-sea elevation at top of Paleozoic strata	Depth of penetration into Paleozoic strata	Total depth of well	Remarks
				Georgia--Continued						
73	Early	Mont Warren et al A. C. Chandler No. 1 Lot 406, Land District 26	10- 2-1943	187	Black shale 6950-7240. Quartzitic sandstone 7240-7320	6950	-6763	370	7320	
74	Echols	Humble Oil & Refining Co. Bennett and Langsdale No. 1 Lot 146, Land District 12	5- 6-1949	181	Sandstone and shale	4108	-3927	77	4185	Diabase sill in Paleozoic strata; see table 4.
75	Echols	Hunt Oil Co. Superior Pine Products Co. No. 1 Lot 364, Land District 13	10-10-1944	148	Black shale	3782	-3634	83	3865	
76	Echols	Hunt Oil Co. Superior Pine Products Co. No. 2 Lot 317, Land District 13	4- 7-1945	142	Quartzitic sandstone	3730	-3588	332	4062	
77	Echols	Hunt Oil Co. Superior Pine Products Co. No. 3 Lot 532, Land District 13	7-29-1947	143	Weathered zone? 3657-3735 Black shale 3735-4003	3657	-3514	346	4003	
78	Echols	Hunt Oil Co. Superior Pine Products Co. No. 4 Lot 219, Land District 13	3-16-1948	156	Red micaceous silty shale; weathered zone?	3911	-3755	5	3916	

Table 4: *Data on wells encountering Triassic? diabase and basalt in Alabama, Florida, and Georgia Coastal Plain.*

[The wells here listed are shown in figures 1 and 2 and some of them are shown on cross sections A-A' and B-B'. The numbers of the wells on the maps and cross sections correspond to those in this table. Elevations and depths expressed in feet, datum sea-level. * Igneous rock determinations by Charles Milton, U. S. Geological Survey. ** Igneous rock determinations by Frank F. Grout, Visiting Professor of Geology, Florida State University, Tallahassee, Fla.]

Well No.	County	Name and location of well	Date of completion	Surface elevation of well	Total depth of well	Depth to igneous rock Top	Depth to igneous rock Bottom	Remarks
					Alabama			
79	Barbour	W. B. Hinton et al J. S. Creel No. 1 Sec. 14, T. 9 N., R. 26 E.	10-26-1939	504	5546	5342 5491	5372 5522	Diabase sills or dikes in clastic rocks of Triassic(?) age. Not studied petrographically.
80	Barbour	H. A. Stebinger Alice S. Robertson No. 1 Sec. 19, T. 10 N., R. 26 E.	3-14-1939	554	5215	*4135 *4202 *4273	4152 4208 4274	*Diabase sills or dikes in clastic rocks of Triassic(?) age.
					Florida			
42	Columbia	Humble Oil & Refining Co. J. P. Cone No. 1 Sec. 22, T. 1 N., R. 17 E.	7-14-1948	141	4444	*3529 3564 4191 *4193 *4248 *4267	3562 3565 4192 4195 4251 4270	*Diabase and amygdular basalt sills in black shale of Paleozoic age. 3564-65 not studied petrographically. Not studied petrographically.
53	Jackson	Humble Oil & Refining Co. C. W. Tindel No. 1 Sec. 8, T. 5 N., R. 11 W.	3-14-1949	128	9245	**8890 8970	8932 8983	**Porphyritic hornblende basalt. A small intrusive or flow in Paleozoic clastic rocks; see table 2. Not studied petrographically.
54	Jefferson	Coastal Petroleum Co. E. P. Larsh No. 1 Sec. 1, T. 2 S., R. 3 E.	1-10-1949	51	7913	*7763 *7850	7792 7890	*Diabase and related kinds of volcanic rocks. Sills or dikes in clastic rocks of Triassic(?) age.
60	Levy	Humble Oil & Refining Co. C. E. Robinson No. 1 Sec. 19, T. 16 S., R. 17 E.	8-20-1949	58	4609	*4317	4377	*4317-4344 decomposed igneous rock; underlies Lower Cretaceous sandstone. *4344-4377 basalt; overlies altered black shale of Paleozoic age; see table 2.
62	Madison	Hunt Oil Co. J. W. Gibson well no. 2 Sec. 6, T. 1 S., R. 10 E.	5-31-1944	107	5385	*4589	4628	Diabase; not studied petrographically. Underlies Lower Cretaceous or older Mesozoic rocks; overlies black shale of Paleozoic age.
63	Madison	Hunt Oil Co. J. W. Gibson well no. 4 Sec. 5, T. 2 S., R. 11 E.	5-18-1945	73	4096	4044	4060	Diabase; not studied petrographically. Underlies Lower Cretaceous or older Mesozoic rocks; overlies quartzitic sandstone of Paleozoic age.
67	Nassau	St. Mary's River Oil Corp. Hilliard Turpentine Co. No. 1 Sec. 19, T. 4 N., R. 24 E.	1940	110	4824	4808		4808-4824 T. D. diabase sill or dike. Underlies black shale of Paleozoic age; see table 2. Determination from Am. Assoc. Petroleum Geologists Bull., vol. 28, no. 12, p. 1723, Dec. 1944; and Florida Geol. Survey Bull. 26, p. 94, 1944.
81	Taylor	Gulf Oil Corp. Brooks-Scanlon, Inc., Block 33, well No. 1 Sec. 18, T. 4 S., R. 9 E.	2- 4-1950	96	5243	5200		**5200-5243 T. D. diabase gabbro; underlies clastic rocks of Triassic(?) or Jurassic(?) age.
82	Taylor	Gulf Oil Corp. Brooks-Scanlon, Inc., Block 42, well no. 1 Sec. 9, T. 8 S., R. 9 E.	12- 1-1949	41	5517	5438		**5438-5517 T. D. diabase; probably a lava flow. Underlies clastic rocks of Triassic(?) or Jurassic(?) age.
83	Taylor	Humble Oil & Refining Co. G. H. Hodges No. 1 Sec. 12, T. 5 S., R. 6 E.	10-28-1948	36	6254	6153		*6153-6165 basaltic rock; underlies clastic rocks of Triassic(?) or Jurassic(?) age. **6165-6254 T. D. diabase gabbro.

Table 4. *Data on wells encountering Triassic? diabase and basalt in Alabama, Florida and Georgia Coastal Plain—Continued*

Well No.	County	Name and location of well	Date of completion	Surface elevation of well	Total depth of well	Depth to igneous rock Top	Depth to igneous rock Bottom	Remarks
					Georgia			
84	Appling	Felsenthal and Weatherford Mrs. W. E. Bradley No. 1 Lot 522, Land District 2	7-30-1947	229	4106	4095		**4095-4106 T. D. altered amygdaloidal basalt; probably a lava flow. Basalt underlies Lower Cretaceous or older Mesozoic rocks.
85	Calhoun	Sowega Minerals Exploration Co. J. W. West No. 1 Lot 328, Land District 4	1-13-1950	345	5265	5190		*5190-5265 T. D. diabase; underlies Lower Cretaceous or older Mesozoic rocks.
74	Echols	Humble Oil & Refining Co. Bennett and Langsdale No. 1 Lot 146, Land District 12	5- 6-1949	181	4185	4125	4150	*Diabase sill or dike in Paleozoic clastic rocks; see table 2.
86	Laurens	Calaphor Manufacturing Co. Grace McCain No. 1 ½ mile south of Minter, Ga.	7-10-1945	280	2548	2532		*2532-2548 T. D. diabase; underlies Lower Cretaceous or older Mesozoic rocks.
87	Mitchell	Stanolind Oil & Gas Co. J. H. Pullen No. 1 Lot 133, Land District 10	8-14-1944	338	7487	6550 7070 *7350	6620 7090 7470	Not studied petrographically. Not studied petrographically. *Diabase sills or dikes in clastic rocks of Triassic(?) age.
88	Montgomery	J. E. Weatherford Lonnie Wilkes No. 1 ½ mile south of Higgston, Ga.	5- 9-1946	293	3433	3415		*3415-3433 T. D. diabase; underlies Lower Cretaceous or older Mesozoic rocks.

Table 5. ***Data on significant deep wells in Alabama, Florida and Georgia Coastal Plain which did not reach pre-Mesozoic rocks.***

[The wells here listed are shown in figures 1 and 2 and some of them are shown on cross section A - A'. The numbers of the wells on the maps and cross section correspond to those in this table. Elevations and depths expressed in feet, datum sea-level.]

Well No.	County	Name and location of well	Date of completion	Surface elevation of well	Total depth of well	Oldest formation penetrated
			Alabama			
89	Clarke	Union Producing Co. M. M. Waite No. 1 Sec. 27, T. 8 N., R. 1 W.	10-22-1941	38	12,399	Jurassic
90	Crenshaw	Nelson Exploration Co. Smith Lumber Co. No. 1 Sec. 26, T. 8 N., R. 16 E.	5-27-1948	396	10,830	Triassic(?)
91	Escambia	Humble Oil & Refining Co. Minnie E. Skinner No. 1 Sec. 10, T. 3 N., R. 10 E.	9- 5-1944	269	11,100	Lower Cretaceous or Older Mesozoic.
92	Washington	Humble Oil & Refining Co. J. R. Williams No. 2 Sec. 21, T. 6 N., R. 4 W.	2- 8-1949	264	15,659	Jurassic
			Florida			
93	Charlotte	Humble Oil & Refining Co. Lowndes-Treadwell No. 1A Sec. 17, T. 42 S., R. 23 E.	12-30-1945	20	13,304	Lower Cretaceous.
94	Collier	Humble Oil & Refining Co. Gulf Coast Realties Corp. No. 2 Sec. 30, T. 48 S., R. 30 E.	10- 2-1944	34	13,512	Trinity age (Lower Cretaceous).
95	Dade	Humble Oil & Refining Co. State of Florida No. 1 Sec. 30, T. 55 S., R. 36 E.	3- 6-1945	15	11,794	Lower Cretaceous.
96	Monroe	Gulf Oil Corp. State of Florida No. 1, Lease No. 373. Sec. 2, T. 67 S., R. 29 E.	4- 1-1947	23	15,455	Jurassic(?)
97	Monroe	Peninsular Oil & Refining Co. J. W. Cory No. 1 Sec. 6, T. 55 S., R. 34 E.	5-21-1939	14	10,006	Lower Cretaceous.
98	Palm Beach	Humble Oil & Refining Co. Tucson Corp. No. 1 Sec. 35, T. 43 S., R. 40 E.	8- 8-1947	34	13,375	Jurassic(?)
99	Pinellas	Coastal Petroleum Co. E. C. Wright No. 1 Sec. 7, T. 30 S., R. 17 E.	7- 2-1948	13	11,507	Lower Cretaceous.
			Georgia			
100	Clinch	Sun Oil Co. W. J. Barlow No. 1 Lot 373, Land District 12	3- 5-1947	177	3,847	Lower Cretaceous(?)