Jackson, Mississippi

May 27, 1941

Messrs D. J. Monroe
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Gentlemen:

I am enclosing herewith copy of manuscript of the Research Committee which has been mailed to Levorsen. So far as I know, the manuscript will appear as it is in the August issue of the A.A.P.G., subject of course to editing by Levorsen and the editorial staff of the bulletin.

Yours very truly

Henry N. Toler

Henry N. Toler

HNT:AS

RESEARCH COMMITTEE REPORT

ON NORTHWEST ALABAMA

The Warrior Basin occupies an area of five thousand square miles in northwestern Alabama. It lies between the Nashville dome of Tennessee and the sharp northeast-southwest trending Appalachian folds in the vicinity of Birmingham. The sediments in the Basin range in age from Cambro-Ordovician to Pennsylvanian. As they have a combined thickness of seven thousand feet and an average thickness of approximately one mile, their volume is estimated to be five thousand cubic miles. These sediments are marine and lagoonal deposits which are roughly estimated to be 60% limestone and dolomite, 25% sand, and 15% shale. Numerous coal beds are present in the Pennsylvanian.

The evidences for the occurrence of oil and gas are the old Fayette Gas Field in Fayette County and outcrops of asphaltic sands and limestones of Chester Age across the north rim of the Basin and numerous shows of oil and gas in wells over the entire area. These shows of oil and gas occur throughout the section from the Ordovician to the Lower Pottsville.

Good shows of oil and gas have been recorded from the Knox in Winston, Franklin and Madison Counties and good shows from the Trenton in Lawrence and Franklin Counties. Mississippian limes are producing a small amount of oil in Madison County and numerous oil shows have been noted in the Bethel sand, Gasper limestone and Hartselle sandstone throughout the area. Especially good shows of oil were obtained in the Hartselle in the Shannon wells near Jasper in Walker County. Gas in commercial quantities was produced for a number of years in the Fayette Gas Field from the Lower Pottsville sandstone.

The structure of the Warrior Basin shows a low regional dip to the south-southwest in the older beds and to the southwest in the Pennsylvanian beds. This low dip appears to continue across the Basin until the proximity of the Appalachian folds is reached, where the beds are highly folded and faulted. The individual structures in the Basin appear to be small and northwest-southeast normal faulting is commonly associated with them. Marked unconformities exist at the base of the Silurian, Devonian, Mississippian and Pennsylvanian systems.

Exploration in this area has been retarded because of the lack of outstanding structures and because of the indurated section which has to be penetrated.

D. C. Harrell

POSSIBLE FUTURE OIL PROVINCES SOUTHEASTERN STATES

By the Mississippi Geological Society
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GEORGIA

The state of Georgia occupies 59,265 square miles of which 35,000 square miles, or 59 per cent, are covered by Coastal Plain deposits. The remainder of the state is covered by basement rocks, with a small area in the northwest corner being occupied by Paleozoic formations. The sediments vary in thickness from zero at the contact of the sedimentary-basement complex to approximately 2500 feet on the coast at the northeast corner of the state; at the southeast corner on the coast approximately 5,000 feet; and at the southwest corner at the Georgia-Alabama line the sediments are probably in excess of 7,000 feet. Using an average thickness of one-half mile for the sediments gives a total volume of 17,600 cubic miles.

All of north Georgia is covered by basement igneous rock with the exception of a small area in the northwest corner of the state which is covered by highly folded Paleozoic formations. In south Georgia, the sediments range in age from Cretaceous to Recent, of which probably 90 per cent are marine, and are composed of lime, chalk, marine sands and shale. The 10 per cent of non-marine section is composed of sand and shale.

Some of the formations are characterized by stratigraphic overlaps due to progression and regression of the sea, and consequently strand line conditions should exist in the section. The regional structure of the Coastal Plains of Georgia is that of a south-southeast dipping monocline, and it is thought that the normal dip of these beds may be interrupted at a few points by local structures.

Georgia - continued

No commercial production of oil or gas has been obtained in Georgia, but there have been a few shows in wells drilled. These shows have occurred in sediments of Miocene, Wilcox and Eutaw ages. At least one authentic oil seep is known to exist and others have been reported.

Oil and gas development in Georgia has probably been retarded due to the relatively thin section of sedimentary beds. There have not been prolific shows of oil and gas in wells drilled and very few pronounced and well defined structures are known. Also, no commercial oil or gas fields have been found in any of the areas adjacent to the state.

References

1. Petroleum and Natural Gas Possibilities in Georgia, Bulletin No. 40 - State Geological Survey, T. M. Prettyman and H. S. Cave.

2. Stratigraphy of Coastal Plain of Georgia, C. Wythe Cooke and A. C. Munyan - A.A.P.G. Vol. 22, No. 7, 1938.

3. Recent Petroleum Activities in Coastal Plains of South Georgia, A. C. Munyan - A.A.P.G. Vol. 22, No. 7, 1938.

4. Geology of Coastal Plains of Georgia by Otto Veach and L. W. Stephenson - State Survey.

5. Mineral Resources of Georgia by S. W. McCallie - State Survey.

FLORIDA

The province of Florida covers approximately 54,060 square miles and is underlain by marine sediments to depths varying from 5,000 feet to more than 15,000 feet and having a volume in excess of 128,000 cubic miles. These sediments consist of approximately 75 per cent limestone and 25 per cent sands and shales, with a negligible amount of evaporites. The percentage of limestone varies from an approximate 50 per cent in the north to almost 100 per cent in the south part of the peninsula. In age, the sediments range from pre-Paleozoic metamorphics to Recent with by far the larger part being Cretaceous and Tertiary.

Significant regional unconformities are known to be present at the top of the Paleozoic and at the base of the Upper Cretaceous in the north part of the state. The regional structure is that of a south dipping monocline, modified by the presence of the very large Ocala structural uplift in the northwest part of the peninsula. The Upper Cretaceous overlaps all the older formations from south to north and probably rests on metamorphics locally in the north part of the province.

Significant shows of oil are not known but gas has been encountered in at least two deep wells and is reported frequently in water wells and springs. Generally, these shows are in Tertiary rocks although a well at Cedar Keys reported gas in the Cretaceous.

The possible presence of closed structural and stratigraphic traps; the known existence of a thick Tertiary and Upper

Florida - continued

Cretaceous section over the entire area; the presence of a wedge of Lower Cretaceous and possible older material in the south part of the Peninsula, and also the known occurrence of Paleozoic rocks within reach of the drill, certainly justify the classification of this area as a potential oil province.

The progress of exploration in Florida has been retarded by the existence of conditions which make present exploration methods difficult or ineffectual. A covering of Recent materials hampers detailed surface mapping, and the difficulty experienced in obtaining dependable seismic reflections has discouraged this type of work. The value of gravity and magnetic surveys is as yet unknown.

References:

1. A Review of the Structure and Stratigraphy of Florida
Stuart Mossom - Florida Geological Survey
17th Annual Report - 1926.

2. Geology of Florida
C. Wythe Cook and Stuart Mossom
Florida Geological Survey
20th Annual Report - 1927-28.

3. Artesian Water in the Florida Peninsula
V. T. Stringfield - 1936
United States Geological Survey Water
Supply Paper - 773-C.

4. Stratigraphy and Micropaleontology of Two
Deep Wells in Florida
W. Storrs Cole
Florida Geological Survey Bulletin 16 - 1938.

5. Outline of Geological History of Peninsular
Florida
Robert B. Campbell
Florida Academy of Science - Vol. 4 - 1939.

SOUTH ALABAMA

The south half of Alabama comprises 22,000 square miles and is underlain by a sedimentary section varying in thickness from zero at the contact of the sedimentary basement complex to possibly more than 15,000 feet on the coast in the vicinity of Mobile. The total volume of these sediments would be in excess of 45,000 cubic miles.

The areas are covered by sediments of Cretaceous, Tertiary and Recent ages and are composed of about 40 per cent shales, 40 per cent sand and 20 per cent lime, of which 75 per cent is marine and 25 per cent non-marine.

A large regional unconformity is known to be present at the base of the Upper Cretaceous as this formation rests directly on igneous rocks in northeast-central Alabama and on Paleozoic formations in the central part of the state. Going down dip, beds of Lower Cretaceous age are known to wedge in and probably rest on igneous rocks and rocks of Paleozoic age. Very few wells have penetrated these beds of Lower Cretaceous age, consequently very little information is available concerning the possible large regional unconformity between the Upper and Lower Cretaceous. Unconformities probably of less magnitude are known to exist at the top of the Cretaceous, at the top of the Wilcox, possibly at the top of the Claiborne, and possibly at the top of the Oligocene.

The regional structure of south Alabama is that of a south-southwest dipping monocline with the surface formations dipping about 10 to 15 feet per mile to the south in southeast Alabama and approximately 20 to 25 feet per mile south by southwest

South Alabama - continued

in the southwest part of the state. The subsurface dip is somewhat greater due to the thickening of the formations southward. Several formations are present down dip which do not exist at the outcrop. This normal south-southwest dipping monocline is interrupted in southwest Alabama by two large well known structural features -- namely, the Hatchetigbee anticline and the Jackson fault, which are located in Choctaw, Clarke and Washington Counties.

About 100 wells have been drilled for oil and gas, of which only a few were deeper than 3,000 feet. Many of the wells have had shows of oil and gas and some drilled 30 or 40 years ago are making enough gas at present to verify the gas shows. In some wells drilled near Mobile, there were several shows of oil and gas with the gas being found at depths ranging from 1500 to 2,000 feet, apparently in sands of Miocene, but by some are considered to be of Vicksburg or Jackson ages. A number of gas seeps are found along the Jackson fault and Hatchetigbee anticline.

Several dry holes drilled on the Hatchetigbee anticline and the Jackson fault, which went to a depth sufficient to test the Eutaw and in some instances the Tuscaloosa, have contributed more to retarding development in south Alabama than any other one factor.

References:

1. Stratigraphy of Upper Cretaceous Series in Mississippi and Alabama
Lloyd W. Stephenson and Watson H. Monroe
A.A.P.G. Vol. 22, No. 12 - 1938.

South Alabama - continued

References (cont.)

2. Reports on Geology of Coastal Plain of Alabama
Eugene A. Smith, L. C. Johnson and
Daniel W. Langton, Jr.
Paleontology by T. H. Aldrich and
K. N. Cunningham
Special Report No. 6 of Alabama Survey - 1894.

3. Special Report No. 14 - Geology of Alabama
George I. Adams, Chas. Butler, L. W. Stephenson
and C. W. Cooke
Alabama Survey - 1926.

4. Special Report No. 15 - Oil and Gas in Alabama
R. D. Sommes
Alabama Survey - 1929.

NORTHWEST ALABAMA

The Warrior Basin occupies an area of 7,500 square miles in northwestern Alabama. It lies between the Nashville Dome of Tennessee and the sharp northeast-southwest trending Appalachian folds in the vicinity of Birmingham. The sediments in the Basin range in age from Cambro-Ordovician to Pennsylvanian. As they have a combined thickness of 7,000 feet and an average thickness of approximately one mile, their volume is estimated to be 7,500 cubic miles. These sediments are marine and lagoonal deposits which are roughly estimated to be 60 per cent limestone and dolomite, 25 per cent sand, and 15 per cent shale. Numerous coal beds are present in the Pennsylvanian.

The evidences for the occurrence of oil and gas are the old Fayette Gas Field in Fayette County and outcrops of asphaltic sands and limestones of Chester Age across the north rim of the Basin and numerous shows of oil and gas in wells over the entire area. These shows of oil and gas occur throughout the section from the Ordovician to the Lower Pottsville.

Good shows of oil and gas have been recorded from the Knox in Winston, Franklin and Madison Counties, and good shows from the Trenton in Lawrence and Franklin Counties. Mississippian lime are producing a small amount of oil in Madison County and numerous oil shows have been noted in the Bethel sand, Gasper limestone and Hartselle sandstone throughout the area. Especially good shows of oil were obtained in the Hartselle in the Shannon wells near Jasper in Walker County. Gas in commercial quantities was produced for a number of years in the Fayette Gas Field from the Lower Pottsville sandstone

Northwest Alabama - continued

The structure of the Warrior Basin shows a low regional dip to the south-southwest in the older beds and to the southwest in the Pennsylvanian beds. This low dip appears to continue across the Basin almost to the Appalachian region where the beds are highly folded and faulted. The individual structures in the Basin appear to be small and northwest-southeast normal faulting is commonly associated with them. Marked unconformities exist at the base of the Silurian, Devonian, Mississippian and Pennsylvanian systems.

Exploration in this area has been retarded because of the lack of outstanding structures and because of the indurated section which has to be penetrated.

References:

1. Ground Water of Northern Alabama
By W. B. Johnston, Jr.
Special Report No. 16 - 1933 -- Alabama Survey

2. Reports on Warrior Coal Basin
By Henry McCalley
Special Report No. 10 -- Alabama Survey - 1900.

3. Rock Asphalts of Alabama and Their Use in Paving
By George Huntington Clark
Special Report No. 13 -- Alabama Survey.

4. Fourth Field Trip Guide Book of Mississippi
Geological Society
Northwest Alabama Paleozoics.

MISSISSIPPI

The state of Mississippi covers 46,865 square miles and is underlain by a sedimentary section varying from a thickness of 5,000 feet in a probable small area in northwest Mississippi to a thickness in excess of 15,000 feet over the greater part of the state. The total volume of sedimentary section would exceed 140,000 cubic miles.

Practically the entire geologic column from Ordovician to Recent is represented. In northeast Mississippi, wells have penetrated several hundred feet into the Knox dolomite. The formations become progressively younger to the south and southwest and in the most southern part of the state as much as 4,000 feet of Miocene beds have been penetrated.

The sediments are composed of approximately 60 per cent marine and 40 per cent non-marine material, of which approximately 40 per cent is shale, 40 per cent sand, and 20 per cent lime. Some of the formations become more marine and calcareous going from the outcrop down dip to the south and southwest; to the east and southeast, the same condition is true.

A large regional unconformity is known to be present at the top of the Paleozoic. At and near the outcrop Upper Cretaceous rests directly on rocks of Pennsylvanian and Mississippian age. Going down dip, rocks of Lower Cretaceous age are known to wedge in and rest on Pennsylvanian. Very little is known concerning the possible large regional unconformity between Upper Cretaceous and Lower Cretaceous. There are smaller unconformities probably of less importance at the top of the Cretaceous, top of the Wilcox and the top of the Claiborne.

Mississippi - continued

There are known to be pinch-outs of some formations around structural features, such as the Jackson Dome, the Sharkey Platform, some piercement salt domes, and possibly on other structures. All formations that may be present between Upper Cretaceous and Paleozoic have to wedge out up-dip as none of them are represented at the surface.

The regional structure of Mississippi is that of a west and southwest dipping monocline at approximately 30 feet to the mile into the Mississippi embayment. This normal picture is interrupted by such large structural features as the Jackson Dome, Tinsley Dome, Kilmichael Dome, Sharkey Platform, the south-central Mississippi Salt Basin, and the large feature in southern Mississippi known as the Wiggins structure, which forms the southern boundary of the salt basin. This major uplift probably extends considerable distance to the west or northwest. In this south-central Mississippi salt basin, five salt domes have been proved by the drill and many others probably exist. In north Mississippi the Paleozoic beds probably have been affected by the Cincinnati arch, regardless of whether it continues in a southeasterly direction and plunges under Cretaceous beds in Mississippi, or whether it turns west.

In addition to the Tinsley Oil Field, the smaller Pickens oil Field, the Jackson Gas Field, and the Amory Gas Field, evidences of oil and gas have been found in a number of wildcat wells drilled over the state. Some 20 wells have had shows of either oil or gas,

Mississippi - continued

and these shows have occurred in a number of the formations ranging in age from Ordovician to Miocene. The more significant ones have been in beds of Cretaceous age. Around the flanks of the Jackson Dome, several wells have had oil shows and some 25,000 barrels of heavy oil have been produced on the southeastern edge of the field. One oil seep is known in Wilkinson County, and there are a few questionable gas seeps.

References:

1. Report on the Geology and Agriculture of Mississippi
E. W. Hilgard - 1860 --Mississippi Geological Survey.

2. The Ground Water Resources of Mississippi
L. W. Stephenson and others - 1928
United States Geological Survey Water Supply Paper 576.

3. Paleozoic Rocks of Mississippi
W. C. Morse - 1930
Mississippi Geological Survey.

4. The Midway and Wilcox Groups in Mississippi
E. N. Lowe - 1933
Mississippi Geological Survey.

5. The Eocene Sediments of Mississippi
R. E. Grim - 1936
Mississippi Geological Survey

6. The Upper Cretaceous Deposits
L. W. Stephenson and W. H. Monroe - 1940
Mississippi Geological Survey.

7. Nos. 1, 2 and 3 Field Trip Guide Books and a book showing subsurface cross sections of central Mississippi by the Mississippi Geological Society, Jackson.

TENNESSEE

The area in Tennessee favorable for oil and gas production approximates 30,000 square miles. The only areas definitely condemned are the Appalachian Valley and Ridge and the Great Smokey Mountains. The sediments include beds from Recent to Cambro-Ordovician in age, furnishing an estimated gross volume of 35,000 cubic miles.

West Tennessee is underlain by beds of Upper Cretaceous and Tertiary ages with a thickness varying from zero to 3300 feet and consisting of 60 per cent sand, 15 per cent marl, and 25 per cent shale. Below this is a little known Paleozoic section consisting of undetermined percentages of dark limestone, shales and some dolomite.

In middle Tennessee there is a composite thickness of 7,000 feet composed largely of Paleozoic limestones, shale and cherty limestones with some sandstone which is in the Pennsylvanian.

Unconformities occur in the Tertiary and Upper Cretaceous and at the base of Paleozoic systems, but probably the most pronounced unconformity occurs at the Upper Cretaceous-Paleozoic contact. In western Tennessee the regional dip is to the west and southwest into the Mississippi embayment at a rate of 25 to 30 feet per mile. Little is known of structural trends but the presence of relatively old Paleozoics immediately below the Cretaceous suggests a possible continuation of the trend of the Nashville Dome through this part of the state.

Tennessee - continued

In middle Tennessee the major structural feature is the Nashville-Cincinnati Axis, bordered to the east by a sag area, to the west by a structural low between Nashville Dome and West Tennessee Arch. This regional fold is interrupted by local features.

In west Tennessee, gas seeps are present along the Mississippi flood plain at and near Memphis. Oil and gas shows have been reported in the Upper Cretaceous in at least a dozen wells and Paleozoic shows have been recorded in two wells. The nearest Paleozoic production is in the west Kentucky coal basin and the nearest Upper Cretaceous production is in the Tinsley Field in Mississippi.

In middle Tennessee, commercial production (small) has been found in (1) lower and middle Mississippian strata in Morgan, Scott and Overton Counties; (2) probably Devonian gas in Robertson County; (3) Silurian rocks in Dickson and Sumner Counties; (4) in rocks of Ordovician (Trenton, Black River and Stones River) age in Clay, Jackson, Overton, Pickett and Fentress Counties; (5) Cambro-Ordovician strata (Knox dolomite group) in Clay, Pickett and Fentress Counties. Oil seeps are known in Ordovician rocks in Davidson, Clay, Fentress, Overton and Pickett Counties and in Silurian strata in Lincoln County. Deeper possibilities (Knox) are essentially unknown. Porous zones have been encountered in Canadian rocks in more than 35 wells. The northern part of Cumberland Plateau, in which productive horizons of Clay and adjoining counties have not been tested, and the northwestern flank of the Nashville

Tennessee - Continued

Arch, where Devonian strata are known to be present and Ordovician section may include porous horizons, must be considered as the most favorable areas for prospecting.

Exploration has been retarded because of (1) covering of loess in west Tennessee; (2) difficulty of working geology in west portion; (3) presence of fresh water in Upper Cretaceous beds; (4) possible absence of younger Paleozoics in western part of state; (5) apparent lack of well developed reservoir rocks above Knox dolomite group in middle section; (6) inconsistency and rapid decline of shallow Ordovician production; (7) restriction of present Mississippian and Ordovician production to small structures.

References:

1. Tennessee Division of Geology - Bulletin 33
Tennessee Coal Fields
L. C. Glenn, W. A. Nelson, Chas. Butts, J. J. Forbes
(5 parts) 848 plus xlix pages, 1925.

2. Tennessee Division of Geology-Bulletin 38
Stratigraphy of the Central Basin
R. S. Bassler
268 plus x pages, 1932.

3. Tennessee Division of Geology, Bulletin 47
Geology and Petroleum Resources of Clay County, Tennessee
K. E. Born and H. B. Burwell.
188 plus xii pages, 1939.

4. U. S. Geological Survey Water Supply Paper 656
Ground Water Resources of Western Tennessee
F. G. Wells
319 plus vii pages, 1933.

5. Bulletin of the American Association of Petroleum Geologists - Volume 11
The Significance of Structure in the Accumulation of Oil in Tennessee
H. G. Lusk
Pages 905-917, 1927.