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Cover Picture

PRECAMBRIAN ROCKS IN OKLAHOMA

TISHOMINGO GRANITE AT TEN ACRE ROCK IN THE ARBUCKLE MOUNTAINS

The Precambrian rocks of Oklahoma are mostly granites and rhyolites, which constitute the basement floor upon which the earliest Paleozoic sediments were deposited. Locally as much as 40,000 feet thick, the Paleozoic sediments bury and conceal the Precambrian rocks in nearly all areas. The largest area of exposure is in the eastern part of the Arbuckle Mountains where, as the result of strong uplift and deep erosion, the Precambrian Tishomingo and Troy Granites crop out over approximately 125 square miles. A second though much smaller area is near Spavinaw in Mayes County, and here, at a locality covering less than one mile square, four tiny buried hills of Spavinaw Granite project to the surface. The largest area of igneous-rock outcrop in Oklahoma is in the Wichita Mountains, but these rocks are believed from absolute age dating to be of Early and Middle Cambrian age.

Illustrated on the front cover is probably the best known locality of Precambrian rock in the State. A low bare hill of coarse-grained Tishomingo Granite, rising above Rock Creek near Troy, NE¼ sec. 3, T. 3 S., R. 5 E., Johnston County, has long been known as Ten Acre Rock. In early days it served as a prominent landmark for the region, and it achieved some fame when in 1915 a quarry was opened on its north slope for the production of dimensional granite for constructing the ground floors of the state capitol at Oklahoma City. Since that time it has been known as the Capitol Quarry, although the quarry face itself has not been actively worked in succeeding years.

The Tishomingo Granite is coarse grained and porphyritic. Flesh-pink subhedral crystals of microcline, as much as 1.5 inches long and 1 inch wide, are set in a matrix of colorless quartz, black biotite, pink microcline, and dull-gray oligoclase. The matrix grains have an average diameter of about 0.25 inch. Thin-section examination shows that the microcline is microcline-perthite. It normally makes up 50 percent of the rock, whereas the remaining essential constituents are oligoclase 20 percent, quartz 22 percent, and biotite 2 to 5 percent. Accessory minerals are magnetite, apatite, zircon, and sphene, which occur together with epidote and fluorite of hydrothermal origin.

The rock locally is cut by pegmatite dikes and veinlets of epidote. In the central parts of some pegmatites are open spaces lined with euhedral microcline and quartz. Dark-purple fluorite also occurs but is decidedly uncommon.

Petrologically the rock is characterized as a two-feldspar granite of igneous origin, emplaced at moderate depths within the Earth's crust. After its emplacement the granite was uplifted, denuded of overlying rocks, and exposed at the surface. It was the surface rock over much of central Oklahoma at the time of deposition of the Upper Cambrian Reagan Sandstone.

The Tishomingo Granite at Ten Acre Rock was given new geological significance when, in 1957 and 1958, scientists from the Carnegie Institution of Washington collected samples and determined its absolute age by an investigation of radioisotopes. Separating zircon crystals from the granite and analyzing the zircon concentrates in mass spectrometers, they determined quantitatively the isotopes of uranium, thorium, and lead. From a knowledge of the rates of radioactive disintegration of uranium and thorium into lead, it was possible to calculate that the absolute age of the granite is 1,400 million (1.4 billion) years. This analysis firmly established the granite as Precambrian, equivalent in age to similar basement rocks in Missouri, Texas, and Colorado.

Subsurface investigations show that the Tishomingo Granite can be traced from the Arbuckle Mountains northward to Kansas, and that in northeastern Oklahoma the granite is bordered on the east by rhyolite and other granites of probable Precambrian age. The granite, rhyolite, and gabbro of the Wichita Mountains region in southwestern Oklahoma are dated at less than 600 million years and are considered to be of Cambrian age.

—W. E. H.

New Theses Added to O. U. Geology Library

The following Master of Science theses have been added to The University of Oklahoma Geology Library during November and December 1962:

Palynomorph fossils from the Goddard Formation (Mississippian) of southern Oklahoma, by Virgil D. Wiggins.

Petroleum geology of southwestern Pottawatomie County, Oklahoma, by Gerald W. Pybas.

Stratigraphy and coral fauna of the Dewey Formation (Missourian), Washington and Nowata Counties, Oklahoma, by J. M. Cocke.

One doctorial dissertation, *Biostratigraphic interpretation and coral fauna of the Wapanucka Formation of Oklahoma,* by Charles Llewellyn Rowett, Jr., was also added.

Petroleum Geology of the North Dover Area Kingfisher County, Oklahoma

Patrick J. Hurley*

INTRODUCTION

The North Dover area, T. 18 N., R. 7 W., in the north-central part of Kingfisher County, Oklahoma, is geologically situated on the eastern flank of the Anadarko basin just west of the northward-trending Nemaha ridge. The eastern area, formerly designated the North Dover field, was combined in November 1961 with the East Hennessey field and is now part of the Dover-Hennessey field.

Production in the North Dover field was discovered in November 1958 by the Jones, Shelburne, and Pellow 1 Meyers (C SW¼ SE¼ sec. 15), the second well drilled in the township. The well flowed 400 barrels of oil per day through an 18/64-inch choke from the Manning zone in the Chester Group of Late Mississippian age. However, the first discovery in the township was the result of a workover of the Allied Material and Decem Drilling 1 Hobbs (C NW¼ NE¼ sec. 30) drilled into the Sylvan Shale (Ordovician) to a total depth of 8,437 feet and abandoned in 1951. L. H. Armer reentered the hole and in July 1958 completed the well for 1,760,000 cubic feet of gas through ½-inch choke and six barrels of condensate per million from the Manning zone. This producing area is named Northwest Dover.

*Geologist, The California Company, Lafayette, Louisiana. The report was written as a Master of Science thesis at The University of Oklahoma, and was condensed by Louise Jordan of the Survey staff.

Table I.—Production Zones, North Dover Area, Kingfisher County, Oklahoma, January 1, 1962

Zone	Type of Production			Total
	Oil	Gas	Oil & Gas	Wells
Manning	74	2	7	83
Oswego	1			1
Oswego and Manning	32	1	5	38
Meramec				0
Meramec and Manning	5		2	7
Red Fork and Manning	1		1	2
Skinner and Manning			1	1
Oswego, Red Fork, and Manning			1	1
Skinner, Manning, and Meramec			1	1
Total	113	3	18	134
Dry Holes				8
Total Wells Drilled				142

In 1958, the Oklahoma Corporation Commission granted 80-acre spacing in lieu of 40-acre spacing for oil wells in Kingfisher County. Although only seven wells were drilled in 1959, development drilling increased in 1960 and 1961 because of the discovery of multiple pay zones and large stratigraphic traps and because of the granting of multiple allowables and wider spacing. At the end of 1961, a total of 142 wells, only eight of which were dry, had been drilled. Five producing zones had been discovered: Oswego, Skinner, and Red Fork of Desmoinesian age (Pennsylvanian) and Manning (Chester) and Meramec of Mississippian age. The Manning is the main productive zone and the Oswego ranks second (table I). Only one well (C NE¼ SE¼ sec. 8), completed in the Oswego in March 1962, did not find production in the Manning.

The total cumulative production to January 1, 1962, amounted to 1,403,111 barrels of oil with daily average pipe-line runs reaching 6,600 barrels of oil during December 1961 (Vance Rowe Reports, 1961). No secondary recovery measures are being used, but some have been considered for the older wells.

STRATIGRAPHY AND PRODUCTIVE ZONES

Permian

The Hennessey Shale of Permian age crops out at the surface, and Permian rocks consisting of red shale, sandstone, and thin beds of anhydrite and limestone occur to a depth of approximately 2,600 feet.

Pennsylvanian

Pennsylvanian rocks of Virgilian, Missourian, and Desmoinesian age consist of approximately 3,000 feet of interbedded shale, sandstone, and limestone. The rocks exhibit a general northwest strike and a southwestward dip that increases with depth. Pennsylvanian strata, as indicated by the structure map (fig. 2) contoured at the base of the Oswego lime, dip at a rate of approximately 55 feet per mile. No evidence of faulting in the area has been found by geological or geophysical investigations. Neither oil nor gas production has been found in rocks younger than Desmoinesian or older than Meramecian.

Figure 1 shows the electric and lithologic logs from a typical well of the lower part of the Missourian section and the underlying rocks of Desmoinesian age, which overlie those of the Mississippian Chester Group with angular unconformity. Two sandstones, Upper Layton and Cleveland, which are productive in other areas, are present in the lower part of the Missouri unit. No shows of oil have been recorded from the Upper Layton zone, which is a light to tan, medium- to fine-grained shaly sandstone approximately 50 feet thick. However, a slight oil stain was found in the Cleveland zone in the Jones, Shelburne, and Pellow Oil Company 1 Meyers (C SW¼ SE¼ sec. 15). The Cleveland zone, which underlies the Checkerboard Limestone, a marker bed for regionally correlating electric logs, consists of approximately 55 feet of very fine-grained to silty sandstone that is locally shaly.

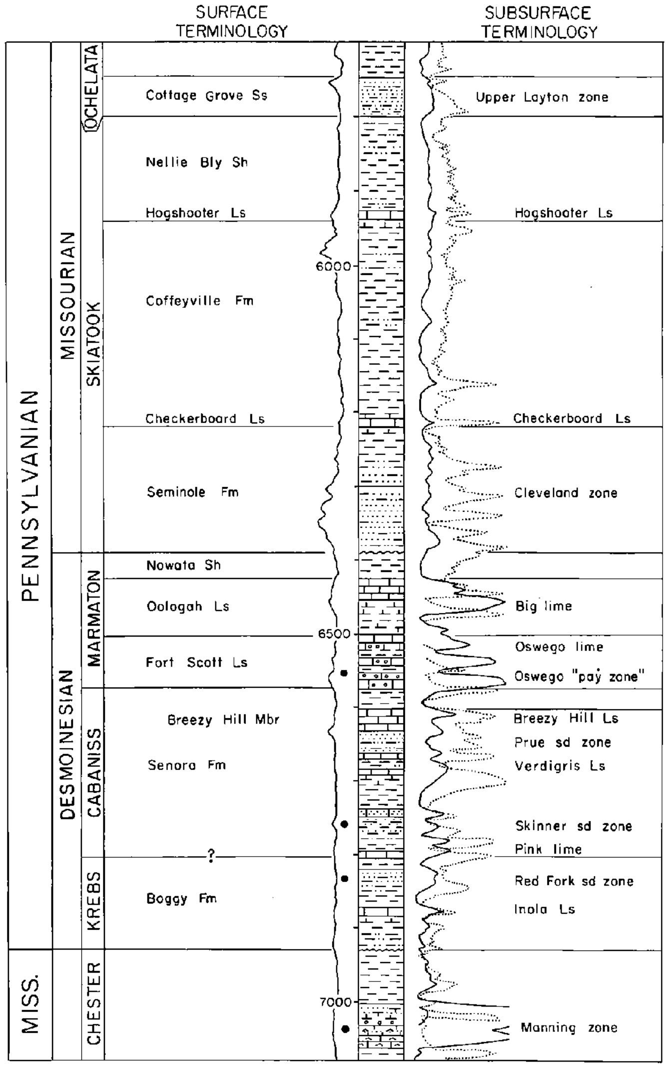

Figure 1. Typical stratigraphic section of lower part of Pennsylvanian and upper part of Mississippian in the Jones, Shelburne and Pellow 1 Meyers, sec. 15, T. 18 N., R. 7 W., North Dover area, Kingfisher County, Oklahoma.

The Desmoinesian sequence of interbedded limestone, shale, and sandstone ranges in thickness from 600 feet in sec. 30 to 400 feet in sec. 1. The northeastward decrease in thickness is due to onlap upon the truncated strata of underlying Mississippian shale. The unit is divided into three groups, each of which contains a productive zone in the area: Marmaton, Cabaniss, and Krebs (descending order).

The Marmaton Group ranges in thickness from 150 to 175 feet and consists essentially of four limestone beds separated by gray shale. The uppermost limestone, Big lime, is separated from the Oswego by 10 to 20 feet of shale. The Oswego is composed of three limestone beds separated by interbeds of dark-gray shale. The upper nonproductive bed is a light-tan to brown, very fine-crystalline limestone. The lower two beds, called the Oswego "pay zone" (Bado, 1961), are 40 feet thick and yield oil. These limestones are buff to light brown, finely crystalline, and, at places, dolomitic and oölitic. The oölites may be either spherical or elongate with concentric rings around a nucleus.

Structure at the base of the Oswego lime (fig. 2) is representative

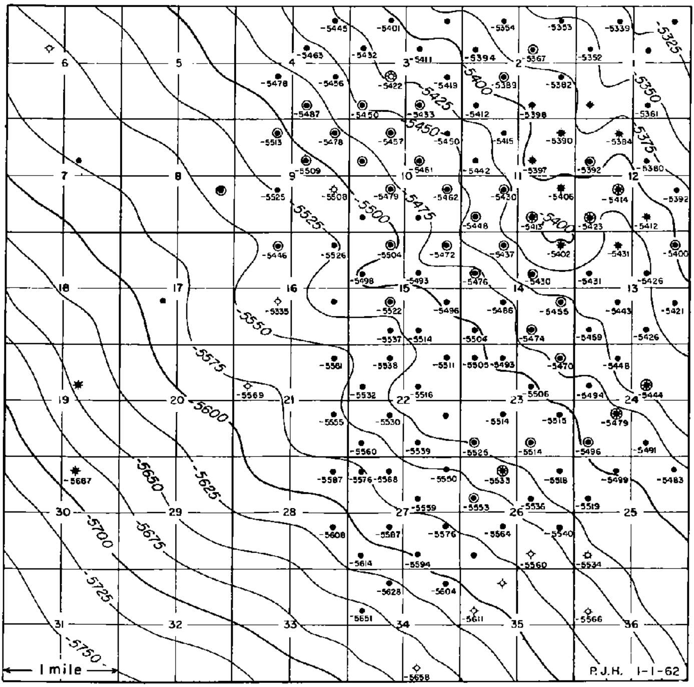

Figure 2. Structure map contoured at base of Oswego lime of T. 18 N., R. 7 W., Kingfisher County. Contour interval is 25 feet. Wells producing from Oswego are circled.

of the structure shown by the remainder of Pennsylvanian marker beds in the area. The Oswego has a northwest strike with an approximate dip of 55 feet per mile to the southwest. Wells which produce from the Oswego are circled on this map, and the structural positions of the Oswego wells apparently have little bearing on good reservoir conditions.

Production seems to be controlled stratigraphically by porosity and permeability changes as indicated by the map showing porosity of the Oswego (fig. 3) where porosity greater than 20 percent, computed from available sonic logs, is shown in feet of section. The average number of feet of productive porosity is about 13 feet with a minimum of 4 feet. Westward limit of production in the area is marked by the 5-foot line. However, in the western part of the township the total thickness of the section with more than 20-percent porosity is greater than five feet at places but the Oswego is nevertheless nonproductive. Absence of production is probably due to nondevelopment of secondary porosity and permeability. Secondary porosity and permeability ap-

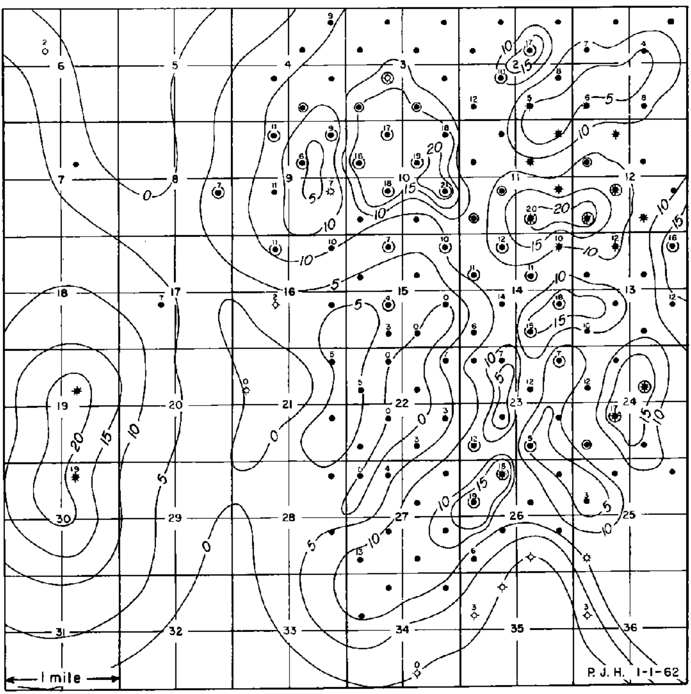

Figure 3. Map showing thickness of Oswego pay zone with porosity greater than 20 percent in T. 18 N., R. 7 W., Kingfisher County. Contour interval is 5 feet. Wells which produce from the Oswego are circled.

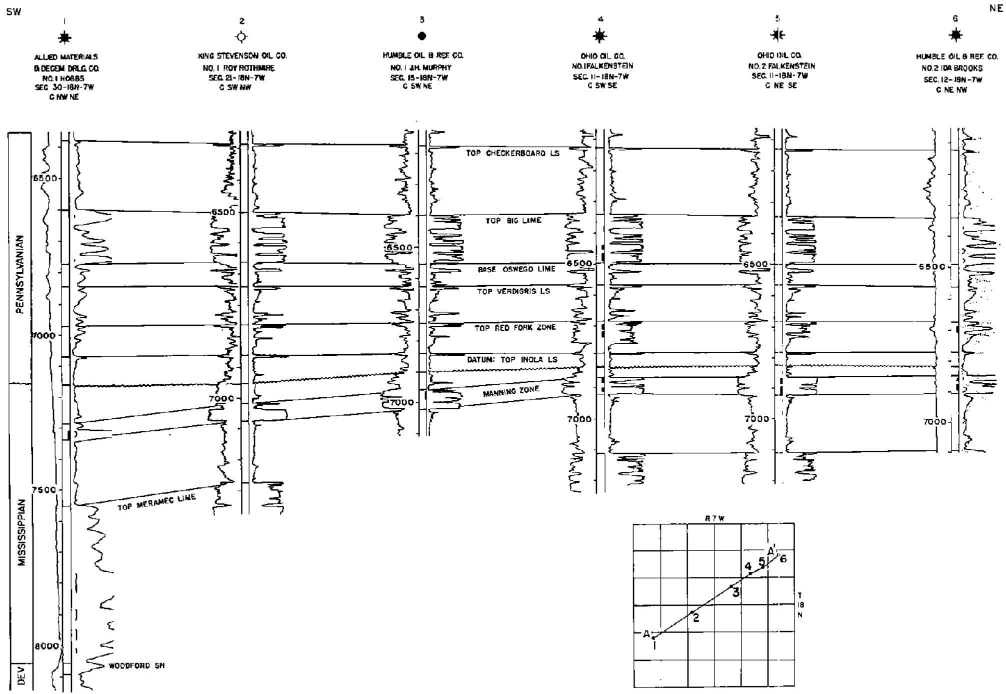

Figure 4. Southwest-northeast stratigraphic cross section in T. 18 N., R. 7 W., Kingfisher County, Oklahoma. Datum is the top of the Inola Limestone. No horizontal scale.

pear to be caused by leaching of oölites as well as of the matrix, and by vertical fracturing.

The Oswego core from the Humble Oil & Refining Company 1 E. Houghton (C NE¼ SE¼ sec. 14) is a highly porous, oöcastic sandy limestone. Porosity in the core is due to the almost complete leaching of the oölites, aided by vertical fracturing. Fracture surfaces are coated with calcite crystals. In the Pan American Petroleum Corporation 1 Clark (C NE¼ SE¼ sec. 8), where production is from the Oswego alone, the core is an oöcastic sparite with vertical fractures. However, in the King Stevenson Oil Company 1 Tharp (C NE¼ SE¼ sec. 27), a core of the Oswego taken at a depth of 6,622 feet is a coarsely crystalline oölitic limestone with primary porosity between the oölites, but without leaching to develop secondary porosity and permeability. Production was not obtained from this zone in the well. In fact, the examination of cores and samples of the Oswego in dry holes shows that the "pay zone" is a finely crystalline, nonporous, oölitic limestone without fractures.

Maximum initial production potential of an Oswego well is from

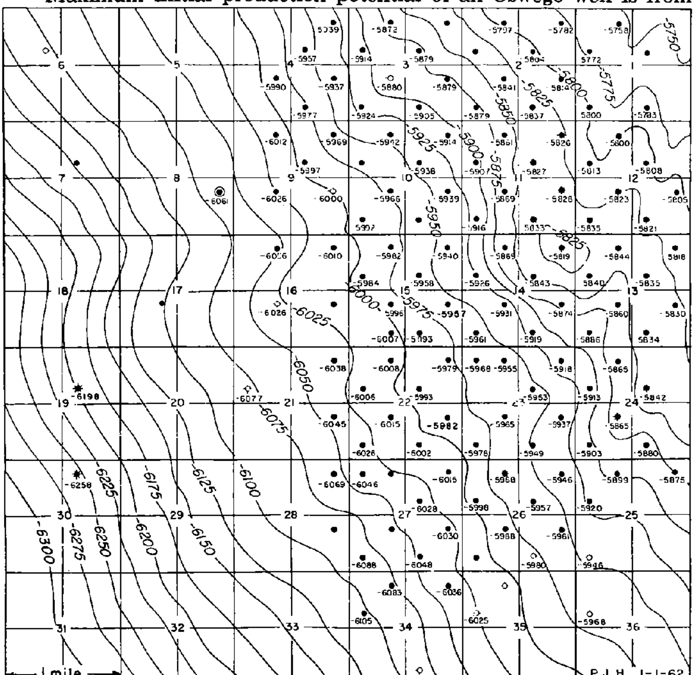

Figure 5. Structure map contoured at base of Manning zone (Chester) of T. 18 N., R. 7 W., Kingfisher County. Contour interval is 25 feet. Well circled in sec. 8 is only well in township without Manning production.

250 to 300 barrels of 40°- to 42°-gravity oil per day. A recovery factor of approximately 75 barrels per acre-foot may be expected.

In the Cabaniss and Krebs Groups (fig. 1), which underlie the Marmaton, four limestones, Breezy Hill, Verdigris, Pink, and Inola, ranging in thickness from 10 to 20 feet, are readily correlated from well to well throughout the area. The groups contain two sandstones, Skinner and Red Fork, which yield gas in the township. The Skinner sand zone, which underlies the Verdigris Limestone, normally contains about 15 feet of sandstone interbedded with sandy shale. However, in the two wells which produce gas from the Skinner (C SW¼ SE¼ sec. 12 and C NE¼ NE¼ sec. 1), the sandstone is approximately 30 feet thick and contains little shale. The Red Fork sand zone, containing a fine-grained sandstone similar to the Skinner, underlies the Pink lime. Gas production with a calculated open-flow of almost 7 million cubic feet per day was discovered in the Ohio Oil Company 1 Falkenstein in C SW¼ SE¼ sec. 11 (well 4 of cross section, fig. 4) and later found in Humble Oil & Refining Company 2 Ida Brooks, C NE¼ NW¼ sec. 12 (well 6 of cross section). Sandstone in the productive wells is approximately 55 feet thick, whereas the adjacent nonproductive wells have about 20 feet of sandstone interbedded with shale.

Mississippian

Mississippian rocks consist of the Chester Group, a shale sequence which contains the Manning zone, underlain by the Meramec-Osage Groups, called the Mississippi lime in most of northern Oklahoma. The strike of the Chester Group is north-northwest, as shown by the structure map (fig. 5) contoured at the base of the Manning zone, and differs from the northwest strike shown in Pennsylvanian rocks (fig. 2). Dip is approximately 80 feet per mile to the southwest and indicates the angular unconformity between Mississippian and Pennsylvanian beds, which dip approximately 55 feet per mile. The Chester rocks are truncated, the shale above the Manning zone having been removed in part northeastward as shown on cross section A-A′ (fig. 4) which is along a line almost at right angles to the strike. Thickness of the Chester rocks ranges from 400 feet in the Allied Materials and Decem Drilling Company 1 Hobbs (C NW¼ NE¼ sec. 30) to 250 feet in the Humble Oil & Refining Company 2 Clark (C NE¼ NW¼ sec. 24) primarily because of truncation of shale above the Manning. Thickness of the Meramec-Osage section is known in only four wells in the township and ranges from 485 to 510 feet.

The Manning zone is the main productive reservoir of the North Dover area. Thickness of the entire zone, determined by laterologs and micrologs, is fairly uniform, ranging from 45 to 60 feet (fig. 6), and does not appear to be affected by structural position. In thinner areas the uppermost limestone appears to grade to shale.

The zone may be divided into an upper and a lower part separated by one or two thin beds of shale. This division can be traced on cross section A-A′ (fig. 4). The upper part of the Manning grades from a white to tan, microcrystalline, fossiliferous limestone in the Hobbs well (sec. 30) to a tan, sandy limestone in Humble Oil & Refining Company 1 Cronkite (C NE¼ NE¼ sec. 26) and is a dark-brown, fine-grained slightly calcareous sandstone that is porous and saturated with oil in Humble 1 Duffy-Couch (C NE¼ SE¼ sec. 3). A core taken from the upper part of the Manning in Humble 1 Stribel (C SW¼ NE¼ sec. 4) is a tan to brown sandy limestone with vertical fractures. The lower part of the Manning is a light-brown, dolomitic, highly fossiliferous, oölitic limestone with vertical fractures. Limestone at the base of the zone is fairly uniform in the area and is tan to brown, highly fossiliferous, and finely crystalline; at places it is vertically fractured.

The structure map, contoured at the base of the Manning zone (fig. 5), shows anticlinal and synclinal noses and closures (NE¼ sec. 14) in approximately the same areas as those shown on the Oswego structure map (fig. 2). The only divergence from the general dip of 80 feet per mile is in sec. 14 where it increases abruptly to 300 feet per mile for one-fourth of a mile and then back to the general dip continuing southwestward.

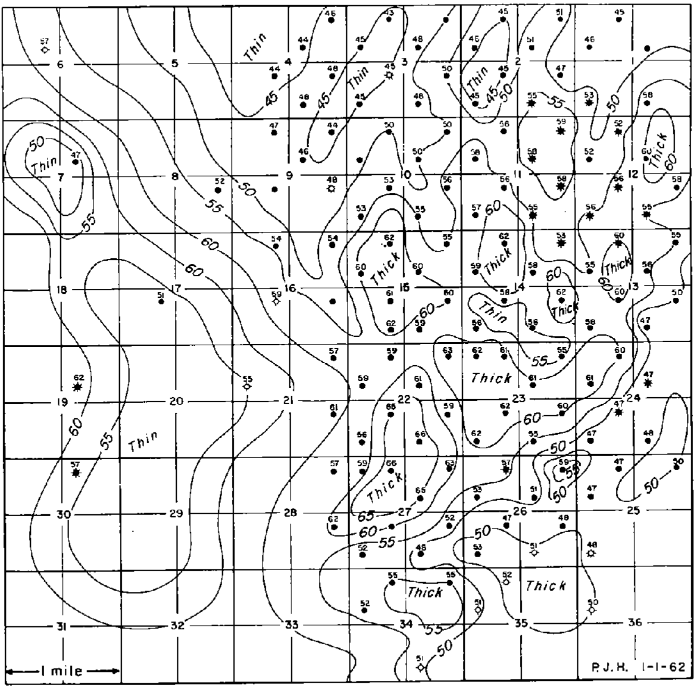

Figure 6. Thickness map of Manning zone (Chester) in T. 18 N., R. 7 W., Kingfisher County. Contour interval is 5 feet.

Production of oil and gas from the Manning zone is primarily from the upper part of the zone and only locally from the lower part. Entrapment of hydrocarbons is the result of the sealing of the zone by Pennsylvanian shale at the Mississippian-Pennsylvanian unconformity, and is further controlled by gradation of the reservoir rock to shale and by variations of porosity and permeabililty.

The porosity map of the Manning (fig. 7) shows an area of little or no porosity separating the eastern part of the township from the western part. Most oil companies regard 5 to 7 feet of porosity greater than 20 percent as the lower limit for successful production. This requirement may explain the absence of production in the area. Sonic logs of the dry holes at the southern limit of the field indicate that the Manning zone has low porosity in that area. Northward production increases with increase in porosity.

The production of gas down dip from the oil wells in two wells in secs. 19 and 30 indicates that a barrier exists between oil and gas production. This barrier possibly is formed by the "no porosity" area

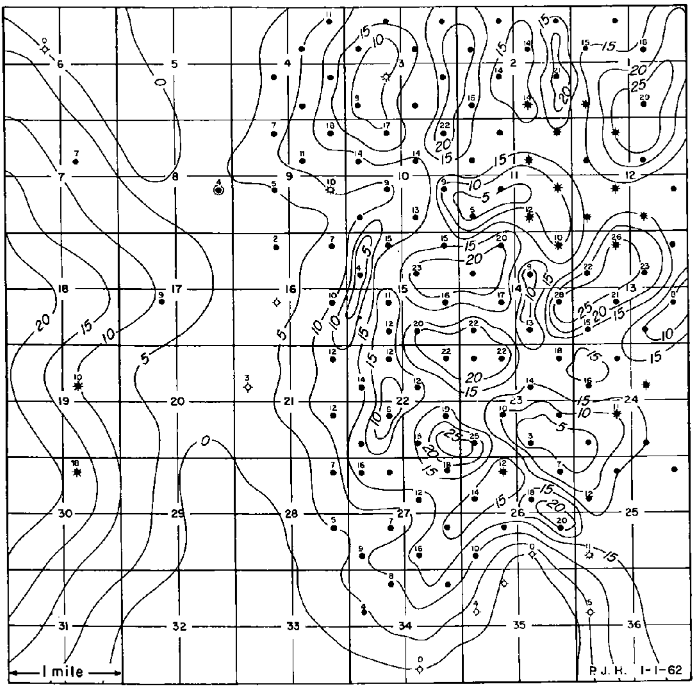

Figure 7. Map showing thickness of Manning zone with porosity greater than 20 percent in T. 18 N., R. 7 W., Kingfisher County. Contour interval is 5 feet. All wells produce from Manning except circled well in sec. 8.

which would trap the hydrocarbons. The two wells then would be producing from the gas cap of this entrapment with oil to be expected farther down-dip.

Maximum expected initial potential of a Manning well is 600 to 750 barrels of 36°- to 39°-gravity oil per day. The recovery factor is approximately 150 barrels of oil per acre-foot.

The Meramec Group unconformably underlies Chester rocks and consists of finely crystalline to granular silty limestone to highly calcareous siltstone. Numerous vertical fractures have been observed in cores. Cores and well logs examined from both productive and nonproductive wells show minor variations in rock type and little porosity.

Structure on top of the Meramec limestone (fig. 8) shows a strike that almost parallels that of the Manning zone and a southwestward dip of approximately 80 feet per mile. The only significant deviation in dip is in sec. 14, where it increases locally to 325 feet per mile for one-fourth of a mile. This local increase in rate of dip corresponds to that of the Manning in the same area. Structural anomalies apparent

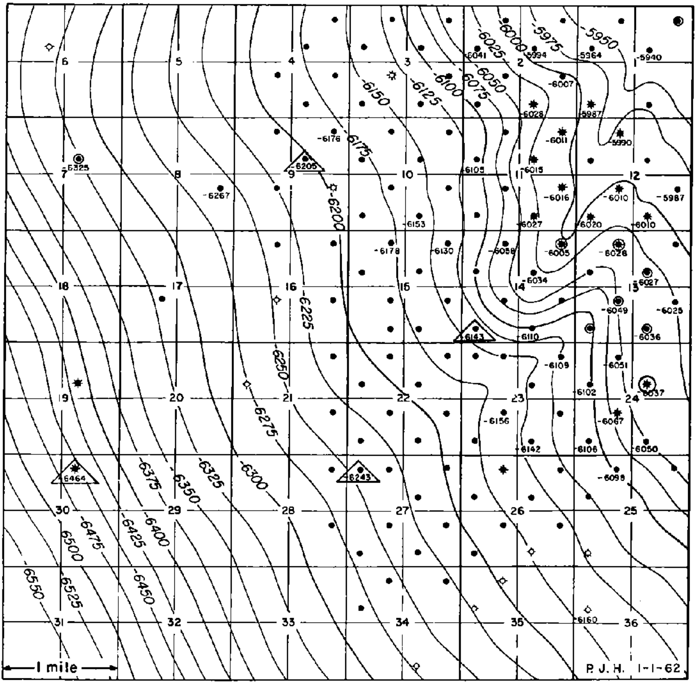

Figure 8. Structure map contoured at top of Meramec Group (Mississippi lime) in T. 18 N., R. 7 W., Kingfisher County. Circled wells produce from Meramec. Deep tests drilled into Hunton rocks are indicated by triangles.

from present subsurface control to this depth are in the same areas as those shown on the Oswego map (fig. 2).

Seven of the nine wells that produce from the Meramec (circled on fig. 8) are located in the east-central part of the township (secs. 13, 14, 24), one in the extreme northeast (sec. 1) and one in the west (sec. 7). Meramec rocks were not tested in all wells which give control for the structure map (fig. 8). Production seems to be related to fracture systems rather than to structure. The successful use of oil or sand fracturing in well completions verifies in part the fracture-control of production. Acid is not used because it might seal primary fractures.

The maximum expected initial potentials of a Meramec well is 800 barrels of 39°- to 40°-gravity per day. No recovery factor has been established.

Only four wells, shown by triangles on figure 8, penetrated the rock section below the Meramec Group. The deepest stratigraphic penetration was made in the Allied Material and Decem Drilling Company 1 Hobbs in sec. 30 (elevation: 1,086 feet) which encountered the top of Woodford Shale at 8,050 feet, top of Hunton Group at 8,080 feet, and top of Sylvan Shale at 8,394 feet, with a total depth of 8,437 feet. The other three tests were stopped in the Hunton section. Because these and older rocks have hardly been explored in the township, they are not discussed in this report.

DRILLING AND COMPLETION METHODS

All wells in the North Dover area were drilled with rotary tools without unusual difficulties being encountered. About 16 days are required from the date of spudding to running the log of a well approximately 7,000 feet deep.

The common completion practice is to drill five feet of Meramec, set pipe in the top and drill in 50 to 60 feet with oil, gas, or air. Although some operators drill as much as 100 feet of Meramec, it is believed that only 35 to 40 feet of effective pay exists (Woncik, 1961).

Production practices for the Oswego and Manning are to set casing through these zones, to perforate the pay zone, and to use acid or water for fracture treatment. Oswego and Manning wells normally have initial bottom-hole pressures between 2,700 and 2,800 psi.

The cost of wells completed in a single zone averages $71,000 and dual completions will average $84,000. Drilling footage price is $3.70 per foot. Coring is done with the use of diamond bits. Coring programs are confined to the productive zones and normally all cored footage is recovered.

Transportation of the North Dover oil and gas is provided by two pipe lines operated by Champlin Refining Company and Continental Refining Company, with Champlin transporting the greater amount.

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An Incertae Sedis Palynomorph from the Devonian of Oklahoma*

L. R. Wilson and J. B. Urban

During a palynological investigation of the Woodford Formation (Devonian) on Buckhorn Creek in Murray County, Oklahoma, numerous microfossils were observed that are not referable to any formerly described. One of the abundant forms, a new genus and species, herein assigned to Incertae sedis is described in this note. The fossil reported here occurs only in the lowest 25 feet of the Woodford Formation section that is exposed in NE¼ sec. 3, T. 2 S., R. 3 E. It is thought that because of its diagnostic features and limited stratigraphic range it may prove to be a valuable horizon marker.

*Study made with the aid of National Science Foundation Grant G22083.

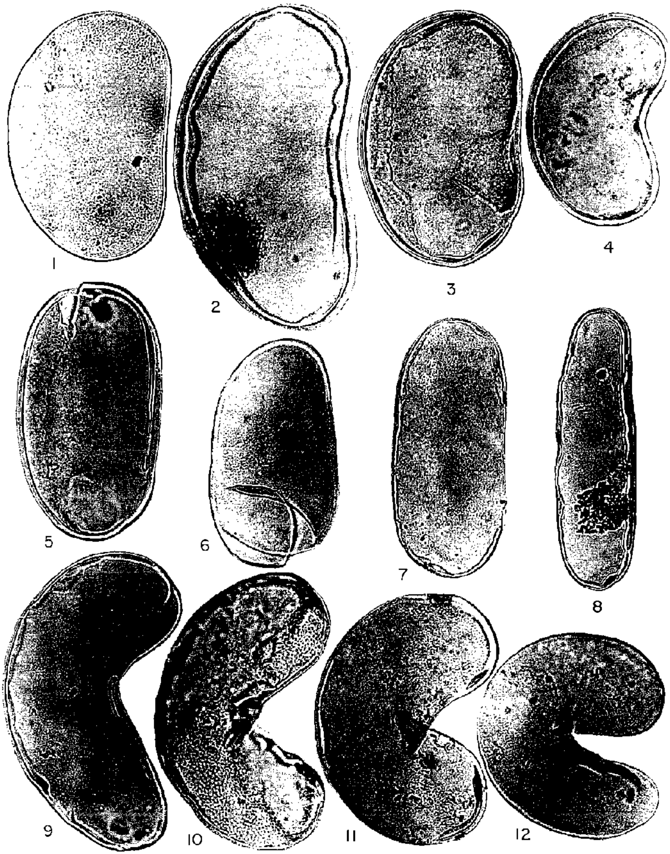
Explanation of Plate I

An assemblage of Quisquilites buckhornensis gen. et sp. nov. showing range of form, size, and disintegration

Figure 1. Holotype, length 123 microns, width 78 microns. Slide OPC 35OD-3-2
Figure 2. Length 124.2 microns, width 64.3 microns. Slide OPC 35OB-3-2 Showing fossil split into two nearly equal parts.
Figure 3. Length 101.2 microns, width 62 microns. Slide OPC 35OB-3-4 Showing partial corrosion of outside wall.
Figure 4. Length 93.2 microns, width 50.6 microns. Slide OPC 35OB-1-2
Figure 5. Length 112.7 microns, width 62 microns. Slide OPC 35OB-2-2 Corrosion of outside wall at ends.
Figure 6. Length 119.6 microns, width 66.7 microns. Slide OPC 35OB-6-1
Figure 7. Length 112.7 microns, width 48.3 microns. Slide OPC 35OA-2-5
Figure 8. Length 140.3 microns, width 36.8 microns. Slide OPC 35OB-3-5
Figure 9. Length 131 microns, width 50.6 microns. Slide OPC 35OB-2-3
Figure 10. Length 89.7 microns, width 32.2 microns. Slide OPC 35OB-3-3
Figure 11. Length 108.1 microns, width 52.9 microns. Slide OPC 35OB-1-3
Figure 12. Length 87.4 microns, width 41.4 microns. Slide OPC 35OB-3-1

The Woodford Formation in the Buckhorn Creek section is 297 feet thick. The lowest 15 feet, except for the basal two inches, is carbonaceous, siliceous, and fissile shale, which weathers from black to emerald green. The basal two inches is a conglomerate consisting of limestone pebbles with a cherty matrix. The upper ten feet of the 25-foot portion containing the new form is also carbonaceous, siliceous, and fissile, but it is pyritic and chocolate brown and weathers tan to red. Limonite staining of the shale is prominent. The chocolate-brown shale is 210 feet thick. Above this is 61 feet of carbo-

Plate I



naceous, pyritic, siliceous gray shale with blocky siliceous beds intervening and approximately 11 feet of carbonaceous, calcareous, phosphate-nodule-bearing and limonitic gray-green beds.

Quisquilites gen. nov.

Bilaterally symmetrical; bean-shaped, oval to terete in longitudinal view, oval to round in cross-section; germinal structure not apparent; wall, translucent to transparent, three-layered, with scattered cylindrical perforations one-half to one micron in diameter; outside layer of wall, smooth or ornamented, approximately one-third as thick as middle layer and slightly thinner than inside layer; middle layer, slightly less hyaline than other layers.

The name of the genus is derived from the Latin word *quisquiliae,* meaning refuse or rubbish, in reference to the great variation in form within the genus.

Quisquilites buckhornensis sp. nov.
Plate I, figures 1-12

Description as for genus; length 85 to 145 microns, width 30 to 79 microns; wall 2 to 4 microns thick, smooth to minutely granular.

Holotype: Slide OPC 35OD-3-2, plate 1, figure 1. Length 123 microns, width 78 microns.

The specific name is derived from the name of the creek along which the fossils were found.

Slide preparations of the fossils illustrated in this note are in the palynological collection of the Oklahoma Geological Survey.

The fossils vary from bean shape to terete and many are bent into crescentlike forms. The walls of the fossils also show various stages of deformation. Some have lost a portion of the outer wall, others have corrosional perforations approximating the diameter of the narrow ends of the fossils, and still others are separated into longitudinal halves or are torn in various ways. All variations illustrated on plate I occur together and thousands of specimens have been examined. The wide variety of size and form is one of the characteristics of this fossil. An attempt to separate the specimens into distinct groups has been unsuccessful because transitional forms are abundant. The sequence of form variation is illustrated by figures 2 through 12; and the holotype (fig. 1) represents a stage intermediate between those of the forms shown in figures 2 and 3.

The paleontological affinity of *Quisquilites* appears to be with *Tasmanites* because each has a perforate multilayered wall and great variability in size, but they differ in shape and ornamentation. The biological affinity, like that of *Tasmanites,* is considered to be with the algae. The microfossils associated with *Quisquilites* are species of plant spores belonging to the genera *Vallatisporites* and *Lophozonotriletes,* and to an undescribed genus. Several species of hystrichosphaerids and *Tasmanites* are also associated with *Quisquilites.*

In the Buckhorn Creek section of the Woodford Formation it is possible to recognize three paleontological zones. The bottom zone is characterized by the presence of *Quisquilites* and the associated fossils noted above. The middle zone is characterized by an abundance of *Tasmanites,* a few hystrichosphaerid species, and absence of plant spores. The top zone contains different plant-spore species and different hystrichosphaerid species from those in the bottom zone, but contains some of the same species of *Tasmanites* as are present in the other zones.

The stratigraphic range of *Quisquilites* in the Buckhorn Creek section is markedly restricted, but the genus has been observed in the Goddard Shale (Mississippian), the Stanley Shale (Mississippian), both in Oklahoma, and a Desmoinesian (Pennsylvanian) shale of northern Texas. Because *Quisquilites* is relatively uncommon in each of these three sections, it is assumed that the fossil has been recycled from Devonian rocks which were exposed and eroded during Mississippian and Pennsylvanian times. In each of these deposits other Devonian microfossils were observed associated with *Quisquilites,* a fact that would strengthen the recycling theory. The only other occurrences of *Quisquilites* known to the writers are from a Devonian deposit in Alberta, Canada, and from one in Peru.

First Annual Meeting — Oklahoma Section of National Association of Geology Teachers

The first annual meeting of the Oklahoma Section of the National Association of Geology Teachers was held at the University of Tulsa on December 8, 1962, in conjunction with the annual meetings of the Oklahoma Academy of Science. Approximately 40 members and visitors attended the all-day program.

The morning session was devoted to talks by invited speakers on the theme, "Continuing Geologic Education for Industry, High School, and the Public." Speakers and their topics were: *Geology course for primary and secondary school teachers sponsored by the Tulsa Geological Society,* by Glenn Visher of Sinclair Research; *N. S. F.-sponsored short course for high school teachers,* by E. C. Stoever, Jr., of The University of Oklahoma; *The university's role in industrial geological education,* by Jack Walper of the University of Tulsa; *The oil man's bible—Chapter and verse,* by Frank Gardner of the Oil and Gas Journal; *Geological seminars of Jersey Production Research,* by Ken Watkins of Jersey Production Research; *Pan American Research Department's carbonate seminar,* by H. J. Werner of Pan American Research; and *Geological Seminars of Sinclair Research,* by James F. Johnson of Sinclair Research. The meeting was also privileged to hear a few remarks by Dr. John L. Snyder, director of education of the American Geological Institute.

Following a luncheon and business meeting, the group participated in a field trip to study "Pennsylvanian Sands and Carbonates in the Tulsa Area, with particular emphasis on Environment of Deposition," led by Gerald M. Friedman of Pan American Research, and M. E. Hopkins, Charles L. Rowett, and Jack Walper of the University of Tulsa.

At the business meeting the following officers were elected: *President,* Gerald M. Friedman, Pan American Research; *Vice-President,* Patrick K. Sutherland, The University of Oklahoma; *Secretary-Treasurer,* Helen J. Weakley, Skiatook Junior High School; and *Editor,* Louise Jordan, Oklahoma Geological Survey. These four, together with Past-President Edward C. Stoever, Jr., The University of Oklahoma, will comprise the Executive Committee of the Oklahoma Section during the coming year. In addition, Brown V. Monnett, Oklahoma State University, was elected to a three-year term as the Oklahoma Section's representative on the Curriculum and Standards Committee of the National Association.

At the time of this writing the Oklahoma Section numbers 42 members, among whom are representatives of all of the colleges and universities within the State which have a geology curriculum, the petroleum industry, high schools, and the Oklahoma Geological Survey. Membership is open to all who are interested "in fostering improvement in the teaching of earth sciences at all levels of formal and informal instruction, in emphasizing the cultural significance of the earth sciences, and in the dissemination of knowledge in this field to the general public." The $3.50 annual dues, of which 50 cents is returned to the section with which a member is affiliated, includes a subscription to the *Journal of Geological Education,* and to *GeoTimes,* which is published by the American Geological Institute. Anyone interested in joining the Oklahoma Section, or in securing further information, should contact Mrs. Helen J. Weakley, Skiatook Junior High School, Skiatook, Oklahoma.

—E. C. S., Jr.

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